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Some Sculpture of the Year.

THE remark made by a sculptor at the Art Congress at Edinburgh last year, that sculpture was only the highest development of mason's work, served at all events to suggest a new view of the relations between sculpture and architecture, as arts which are both concerned in modelling or building up conceptions in the round, in stone or some analogous material. In proportion as the masonic element is the more prominent in sculpture, in that proportion it approaches to closer contact with architecture, and is decorative; in proportion as it departs from these masonic or architectonic conditions it approaches to the conditions of pictorial art. A good deal of modern sculpture is pictorial in style rather than architectonic, and though this pictorial use of sculpture has its own charm, there can be little doubt that the tendency in this direction, so far as it has gone, marks a decline from the highest ideal of sculpture, which, even where it is not treated as a decorative adjunct to architecture, should be so far architectonic in character as to be simple in its lines and well balanced and firm in its structure. These conditions being satisfactory, we have then to consider the value of the intellectual idea expressed in the work, which must also be simple and concentrated. A complex idea can hardly be well represented in sculpture. What we look for is the portrayal of a moment of action and expression which seems to express and include the main characteristics of the personage, historic or ideal, who is portrayed, or the central thought which is in the sculptor's mind; and this should be expressed through the medium of a figure also simple and typical in its attitude and in its lines, well balanced constructively, having something of that character of standing firm on its base which belongs to architecture, something of that well-knit structure and that severity of line which are essential to architectonic conditions. An ill-balanced figure in sculpture is as much *hors ligne* as the leaning tower of Pisa in architecture.

The central work of the year, among Royal Academy sculpture, the monumental statue of Gordon (1,958) by Mr. Onslow Ford, appears to answer well to these requirements. We fear that the idea of representing Gordon seated on a camel looks as if it arose a little more from the sculptor's desire to model a camel than from any innate conviction that this was the most suitable way of portraying our lost hero—every artist is on the *qui vive* nowadays for a new effect; but the group stands well, the figure is very well seated on the saddle, and the attitude is simple and devoid of any striving after effect. Mr. Ford has the honours of this year in sculpture, for his "Music" in the Lecture Room (2,118), although not placed in one of the central positions in the room, is certainly one of the best works, if not the best, of the year. This is a figure of a woman singing to a lyre which she has just struck with her right hand. The hand has been drawn back again with a dramatic flourish which Mdme. Schumann would have highly disapproved of*; but the figure is finely modelled and most satisfactory in pose and balance. The lower portion is half concealed by a piece of drapery which hangs in a negligé manner from the girdle; this serves to give greater breadth to the figure. The odd fancy of placing an owl on the head of the figure seems to have arisen from a wish to get the effect of showing the face shadowed between the bird's drooped wings; this is very effective, and gives a special expression to the work, but one does not see its relation to the subject. The same artist's "Peace," of which the completed bronze is exhibited this year, was hardly so great a success as to justify a second exhibition; it is a pretty and well-modelled figure but a poor conception.†

The central places on the two long walls of the lecture-room are occupied respectively by the two works of which illustrations are given in this number: Mr. Lawes's "Design for a Relief" (2,004) and Mr. Armstead's "Guardian Angel" (2,063). The former, which is a large work (figures nearly life-size) appears to be an allegory of the spread-eagle description, the figures representing "America, Liberty, Peace, Commerce, Indians, the Extinction of Slavery, and Abundance"; the catalogue omits "America" from the list, which has been furnished to us by the artist. The whole is surrounded by an architectural framework, of which the lower portion, which is a kind of immense bracket for carrying the projected mass of sculpture, is not shown in the illustration. This is an exceedingly clever work with a great deal of spirit and energy, but it is decidedly not architectonic sculpture, in spite of its semi-architectural frame; in fact, it is a most pronounced example of pictorial sculpture, and looks like a picture of Lebrun or some other painter of "la Siècle" which has sprouted into relief. Instead of being architecturally combined with the background, the object of the sculptor seems to have been to detach it completely, and to leave the whole mass of struggling figures as a kind of excrescence protruding from the wall plane. This is certainly not the way to treat decorative sculpture. Mr. Armstead's more sober and reticent work is a part only, as appears from the catalogue, of "a memorial to an only daughter"; it would have been of interest to see a sketch of some kind of the whole memorial, so as to see the relation between the sculpture and the architectural design: the group, as it is and taken on its own account solely, is a graceful composition imbued with a touching sentiment; the manner in which the angel's wings form a kind of framework of shadow round the whole is very effective and adds to the sense of repose in the group. In his group of small-scale figures for the reredos of St. Mary's Church Aberavon (a general drawing of which is to be seen in the architectural room), Mr. Armstead seems to have been rather under the influence of ecclesiological ideas and has adopted a certain rather mannered type of figure for Christ and the evangelists, such as may be said to be more orthodox than original, except in the case of the figure of St. John, which appears to us the most successful of the group, and of which we give an illustration.

The fancy for treating statues with the head in shadow is illustrated again in Mr. Frampton's figure "The Angel of Death," (2,090), in which the head is also shadowed with wings, in this case attached to the figure itself, and by which the face is so far shadowed that it is somewhat difficult to see the features. The figure is a thin emaciated life-size nude, carrying a scythe over the shoulder and poised on one foot in the attitude of walking, the other foot being extended in the air behind it. This is an attitude which has been frequently used in bronze figures, for which only it could be practically possible without danger; and of course a bronze w rk

* Mdme Schumann, as related in a recently published book of musical gossip, strongly rebuked a young pianist for throwing her hands up at the end of a difficult passage, as a kind of flourish out of keeping with true artistic feeling.

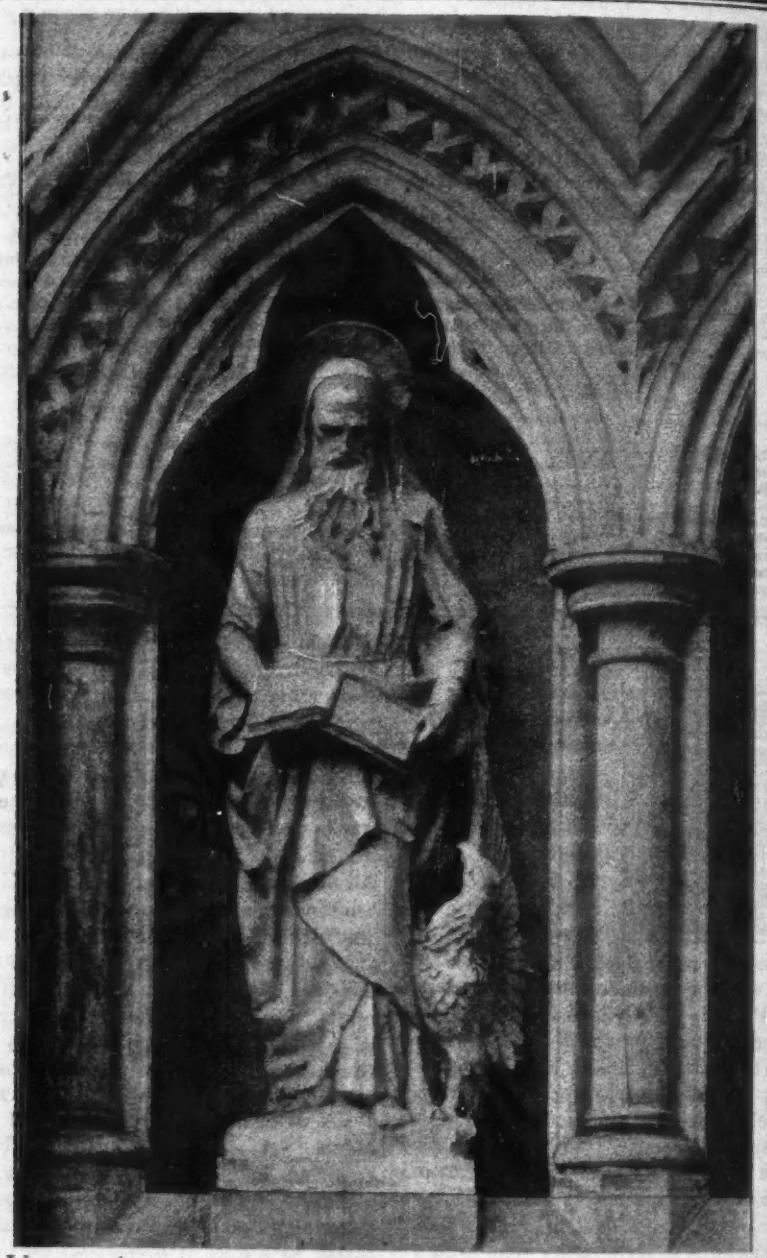
† An illustration from the plaster model was given in the *Builder* for May 7, 1887.

comes out of the category of masonic sculpture; but it may be questioned whether this method of planting a figure is not at variance with the true genius of sculpture. There is a poetic feeling in this work, which is very expressive in its way, but both the pose and the method of shadowing the face combine to place it rather in the category of pictorial sculpture—design which would be better suited for treatment in painting.

Mr. Harry Bates's "Design for an Altar, Holy Trinity, Chelsea" (2,861), is eminently suited for its position. It is a long panel in very low relief, a figure of the dead Christ in the tomb, with an angel stooping over the head and another in like attitude at the feet. The angels are treated in a manner entirely suitable to architectural decoration; they are in almost similar attitudes at each end of the panel, the wings drooped behind them are arranged as a decorative filling to the ends of the panel. The figure of the dead Christ, recumbent, seems to us to be open to question in one respect, that it is treated so as to show rather too much of the front of the figure and the further limb, so as to have the effect of lying on a plane inclined towards the spectator. Very low relief like this comes so nearly into the category of pictorial perspective that it is difficult to draw the line between the two; but it is appears to us that, for a relief, this figure is treated a little too much like a drawing, with the effect on the eye which we have described, and which is not quite satisfying. Mr. Bates's other work is a kneeling marble figure of Pandora, with a small and beautifully-modelled head, stooping forward over the fatal casket, which is treated in ivory with a delicate frieze of figures on the sides, a very pretty decorative incident.

Mr. Hamo Thornycroft's diploma work "The Mirror" (2,057) is a small and very charming bas-relief of a mother and child, the latter leaning back from her knee to look in a hand mirror. Two other low-relief works near this which may be noticed are Mr. Le Quesne's "Spring" (2,062) a pretty sketch in low relief of a head in profile with rather too long a neck, but graceful in design and free in execution, and a profile "portrait" (2,064) in marble by Mr. T. S. Lee, in which the artist has gone to about the furthest possible extreme in making sculpture into painting; the hair and portions of the profile are just lightly touched so as to lose themselves almost imperceptibly in the ground plane of the marble. The surface of the face is polished to the extent of giving it rather a waxy appearance. The effect is unusual and *recherché*, perhaps, but is this truly "sculpture"? It seems rather like playing on the confines of an art in which everything should be clearly defined.

Mr. A. G. Atkinson's "Out in the Fields" (1,956) is one of the attempts which we see now and then in modern sculpture to bring purely realistic subjects of rustic life within the boundaries of the art. Mr. Thornycroft's "Mower" has been the parent, probably, of some of these attempts in English sculpture; but though the boots and other articles of dress of his figure were perhaps too forcibly realistic, the pose of the figure was statuesque and fine—hence a great part of its success. Mr. Atkinson gives us a "clod" of the fields, spade in hand, and with clownish countenance; the surface of the dress is stained so as to appear discoloured with soil. The thing is well done, but it is not a thing of beauty, nor can we imagine that any one would care to possess a life-size work of this type. This is the kind of thing to paint on a small scale, as has been done by Knaus and other German artists; it is not the sphere for sculpture, which is too ideal an art to be used in this way. The want of intellectual perception of another kind, often painfully evident in English sculpture, is to be seen in such figures as the commonplace "Hypatia" in the Central Hall, and the large figure in the lecture-room of "Sophocles leading the chorus of victory after the battle of Salamis." This latter shows a head of a well-worn conventional classic type, on the figure



St. John: one of a series of five figures for the Reredos of St. Mary's Church, Aberavon. Mr. H. H. Armstead, R.A., Sculptor. No. 2,050, *Royal Academy Exhibition.*

Design for a Medal for the Worshipful Company of Musicians. Mr. C. B. Birch, A.R.A., Sculptor. No. 1,984, *Royal Academy Exhibition.*

of a mature man of rather thin and lean torso, with the ribs showing in a very pronounced manner. Now the event supposed to be illustrated occurred when Sophocles was quite a youth, and he was chosen to lead the chorus and dance on account of his delicate and almost feminine beauty, so that the figure by no means represents the incident intended.

Among the numerous portrait busts is a very spirited one of Lord Dufferin by Sir J. Boehm, a fine bust of Mr. Blake Wirgman (1999) by Mr. Thornycroft, one by Miss Alyce Thornycroft entitled "My Mother" (2,000), a very dignified head, and a fine study of an old woman's head by Mr. G. A. Lawson (2,008). Among minor things we may mention Miss E. M. Rope's very pretty little bas-reliefs of children, reliefs for a mantelpiece (1,985 1991), Miss Emmeline Halse's design for a decorative frieze (1,977), dancing figures modelled on a small scale in wax on a wood panel ground—this is a very pretty little bit of work; and Mr. Birch's design for a medal for the Company of Musicians (1,984), of which we append an illustration.

There are but two or three works among those we have mentioned in the Academy which could hold a place in the first rank in the Salon, if transported there. Not only is one struck with the far greater proportion of works, in the numerous Salon collection, which show real power in modelling, but with the superior intellectual character and force of the best French sculpture of the day. As before observed, it may be a question whether the French, with the exception of a few leading men, are not rather astray about painting at present: but there is no doubt whatever about their sculpture. Take what is perhaps the finest work of this year, the "Femme au Paon" of M. Falguière, which fronts the visitor opposite the principal entrance. The idea of this is really the same as that of the artist's painting called "Juno" last year, and it is not easy to understand why he should have abandoned this ideal title for a prosaic one, especially as the woman and peacock are standing on "conventional clouds," the only weak point in the work, for which the title of "Juno" would at any rate have afforded an excuse and explanation. Not only is this one of the most splendidly modelled examples of a perfectly fine female figure, but the head is of the noblest type—a type which M. Falguière seems to have developed for himself, first in his "Diana" and now in this figure, and which is the very embodiment of womanly dignity and chastity of expression. The pose of the figure is as dignified as the physiognomy; in conception and execution this is an ideal type of sculpture, complete as far as it goes, but expressing one simple idea, and attempting no complication beyond the proper limits of sculpture.

Among the prominent works of this year is M. Lemaire's colossal bronze statue of Du Guesclin, Constable of France in the fourteenth century, of which we give an illustration: a figure upon which Englishmen ought to look with respect, as it was he who was mainly instrumental in ejecting the England of that day from her partial footing in France. The sculptor of what may be called a portrait statue is at an immense advantage, no doubt, when he can make use of so picturesque a dress as a suit of Mediæval armour; but even making allowance for this advantage, what a remarkable work is this both in sculpturesque quality and in the half-fierce half-heroic individuality which is given to the figure. We can recall nothing in English military sculpture to stand against it at all since Foley's "Outram," which unfortunately did not remain in England. Du Guesclin forms the centre figure in the southern portion of the sculpture court. Among the more prominent works grouped around is M. Roulleau's "Leda," which has been purchased by the State; this is unquestionably a very powerful work, the figure is finely modelled, the swan's plumage splendidly treated, the outer wing raised, the other forming a kind of background to the figure of the woman, who is not yet enlightened as to the supernatural character of the bird, and checks it with her hand, with an expression of mild surprise on her face. All this is exceedingly clever, but it is a curious commentary on French ways of thinking, that a paternal Republican government should thus purchase, for the edification of its citizens, a work the real meaning of which could not be explained to any decent woman (or so at least we should think in England). That Leda should have been a favourite subject in the time of the Renaissance is not surprising, but one might think it was time to have done with such a *motif* in these more decorous days. In a prominent position in this part of the court is M. Fremiet's equestrian statue of Velasquez, a very fine and powerful thing, but the costume, no doubt historically correct, is unfortunate for sculpture. M. Cordier's "Eve" is a finely-modelled figure but not with any special originality of idea, and the representation of the loose hair hanging over the body, conveyed by scoring the torso with incised lines, is a false trick of execution which we do not approve of. There are a number of works around here not of the first order (according to Salon standard), but remarkable for the number of distinct and original fancies which they display; M. Dagonet's "La Nuit"; M. Guglielmo's "Faucheur" sharpening his scythe, a piece of frank and almost brutal realism—there is no attempt at sculpturesque grace, but also there are no boots, as in Mr. Thornycroft's "Mower"; M. Tony Noël's "Querelle d'Amour," a beautifully-modelled nymph raising an arrow into the air to chastise a little Cupid who clings about her legs; M. Gautherin's "Avant l'Orage," a girl with flowers gathered in her skirt, looking round with an expression of apprehension, her dress blown about by the coming storm, a very expressive work. M. Pech exhibits his idea of Sophocles dancing at the head of the Chorus, not a very great success, but M. Pech at least knows that Sophocles was a youth and not a man at the time, and does not misrepresent him as he is misrepresented at the Royal Academy. There are many other works on which we made notes, but which we must pass over to look up the side of the court where the monumental works of the year are mostly arranged. These are indeed a remarkable group. One of the principal of them, M. Delaplanche's monument to the Archbishop of Bordeaux, we give an illustration of. It is an admirable example of the combination of sculpture in an architectural whole, and also of that intellectual treatment of a monumental subject by the addition of ideal figures grouped around the portrait figure, in which the French so much excel. These two figures, of life-size and in a very grand and broad style, represent apparently Charity and Faith. The bold manner in which the escutcheon is treated as a decorative centre will not escape the architectural reader. Among the finest of the monumental works, after this, may be named first M. Coutan's colossal figure of a woman in large and ample draperies seated between two great scroll or cantilever features which seem like the buttresses to a tomb-stone; this is for the tomb of Madame Louis Herbette, and bears the inscription,—

Oh vous qui j'aime et qui m'aimez
Je vis, je vis en vous.

A fine work is M. Albert Lefeuvre's "Pour la Patrie," two allegorical figures, the one robed the other armed, the latter represents "Duty"; the two step onward hand-in-hand, and each looking a little to the right as if at some common object of devotion. M. Chapu exhibits a monument to Flaubert the novelist; a mighty slab, in the upper portion of which is the head of Flaubert as a cameo in a sunk medallion; below is a fine nude nymph, apparently Truth seated on the well-curb; between her and the medallion a laurel grows over the slab in low relief. Near this is the same sculptor's "Danseuse," a figure in a tranquil pose and as if seen through transparent drapery,—a trick a little below M. Chapu; the figure is treated as a relief in a niche, and has a charmingly expressive head, to which her fan forms a kind of nimbus. M. Levasseur's "Le Premier Né," a group of father mother and child, merits special mention for its fine and carefully-studied composition and the harmony of its lines, illustrating that architectonic quality which we have been claiming as a proper attribute of sculpture.

Among the works at the upper end of the court is M. Charpentier's fine and poetic figure entitled "Chanson," a kind of embodiment, in a splendidly-modelled female figure, of the abandon of Song,—

"Insoucieuse, un peu bohême,"

with head to one side and holding up a flower in one hand. The expression of light-hearted gaiety in this work, quite within the proper limits of sculpturesque expression, is remarkable; we could not do it in England, for we have not, as a nation, the quality which it represents; it would almost startle people if found in the room at Burlington House, that home of sobriety; there is an attempt at something of the kind in Mr. Montford's "Venus Triumphant," but how harmless and conventional in comparison with the French sculptor's exuberant and yet refined conception. M. Laporte's group "La Conscience," is a very fine work of a more serious type, illustrated by two lines from Victor Hugo's "Légende des Siècles":—

"Vous ne voyez plus rien, dit en tremblant Stella;
Et Caïn répondit: 'L'œil est toujours là.'"

Stella (Cain's daughter) kneels looking up anxiously at him, Cain looks away in the same direction; in expression and in composition the whole thing leans as it were towards the direction of the dreaded vision; the composition is fine, the expression of the group very powerful. Among other works in this part of the court are M. Teixeira-Lopes' "Veuve," a most pathetic group of mother and child; M. Engrand's "La Rêve," a strange but attractive fancy, showing a nude woman asleep in a beautiful half-seated pose on the back of a chimæra monster which represents the dream; and M. Puech's very remarkable work "La Sirène," which is another striking example of the powerful intellectual treatment often found in French sculpture. This is a figure of a fish-tailed siren floating along in a prone position but with her body half raised, and carrying on her shoulder a youth to whom she is turning up her face in a feigned expression of love and tenderness; the boy's face expresses with remarkable power the mingled feeling of interest with apprehension; as a piece of expression this face is a most remarkable study, and the whole work, besides being splendidly executed, is a perfect poem in marble. This, we see, has been purchased by the State, and was well worth the honour. Another dream subject which is curiously expressive is M. Dampt's "La Fin du Rêve," where also the chimæra figures the dream, this time seen only as a subordinate object flying off; the point of the work lies in the expression of the awakened figure, sitting up with a face full of melancholy and apprehension. Another work purchased by the State, and one of the finest things of the year, is M. Marqueste's "Perseus Slaying the Gorgon." This is a remarkable group both for force of conception and finish of execution. Perseus, his handsome features, under a splendidly-decorated helmet, showing only a calm resolution, stoops over the prostrate figure of the Gorgon, clutching the snakes of her hair at the back of the head to keep her face from him; the woman-fiend, with her mouth open in a scream, struggles to get her face upwards to exercise her power of turning him to stone: but her adversary is relentless in his calm power. With the exception of the scream of the Gorgon, which is perhaps a slightly violent incident for sculpture, there is a Greek calm and reserve about the group, and the figure of Perseus is fine and impressive in shape and action from every point of view.

Another among the State purchases is M. Carlier's "Gilliatt Saisi par le Pieuvre," from Victor Hugo's obstreperous romance; the

sculptor has shown a fitting reserve with the expression of terror in the man's face, which is powerfully represented without going beyond the limits imposed by sculpture.

There are many other works well worthy of mention among the Salon sculpture, which for lack of time and space we must pass over. Taking this as the representation of French sculpture for one year, and comparing it with our little show at the Royal Academy, the contrast is extraordinary enough, and the evidence of mental vigour and power of invention as well as of execution among French sculptors at present is extraordinary. Whilst in our opinion (which, as not feeling at liberty to speak with authority on the technique of sculpture, we express with a certain diffidence) the executive power of French sculptors is considerably higher than that of their English compeers, the more striking contrast (whereon we speak with no diffidence at all) is in regard to the intellectual quality of the French work. In walking through the collection at the Palais d'Industrie we are confronted by new ideas, new treatments, and new force and meaning given to old subjects; we are gaining new poetic conceptions of the subjects; and this not in isolated instances, but in the case of a large proportion of works. How often do we get new ideas from the sculpture-room at the Royal Academy? The difference, however, is not only in the artists but in the public. In practical England the vast majority of people are absolutely indifferent to so purely abstract an art as ideal sculpture; they do not want it, they do not even know what it means. Until there is some difference in this respect, some desire on the part of the English public for high-class sculpture, we must probably remain in this respect at our ordinary level of respectable commonplace, in regard to the conceptions of sculpture.

BREAKWATER CONSTRUCTION.*

BY F. H. CHEESEWRIGHT, ASSOC.-M.INST.C.E.

As a fallen tree or a floating log may have given to the inhabitants of Tyre (the earliest sea-going people of whom there is any record) the first idea of a ship, so doubtless artificial breakwaters originated from the models supplied by nature herself in the projecting promontories of a rocky coast. The Tyrian sailors, storm-tossed in the Ægean Sea, often found shelter in the smooth water formed by the jutting horns of a land-locked bay, the rocky horns breaking with passive yet stubborn force the fierce tumultuous masses of water hurled against them by the outer sea. It is but reasonable to suppose that the experience gained upon the coast of Greece, with its countless natural harbours, should have suggested to the Tyrians the way of rendering their own port, lying on an exposed and unprotected shore, accessible in all states of weather, and hence, doubtless, their famous mole. At first sea-going people would probably confine their voyages to ports which possessed safe anchorage; but it often happened that large populations, attracted by local advantages, such as a healthy site or a fertile soil, settled on various points of the sea-board which afforded no facilities for the reception of shipping. Increase of wealth made it necessary to open communications with other nations, and art had then to supply what Nature had begrudged. Large masses of stone were piled at a suitable spot upon the sea-shore, and gradually the heap was carried seaward, just as at the present day a railway embankment is carried across a wide stretching valley. This system of barrier or breakwater building was that first adopted; and, strange to relate, it is the only one that the ingenuity of man has up to the present day been able to conceive; for although modern engineers have modified, varied, and improved the system, it is no exaggeration to say that in all essentials the last magnificent structure erected by our most eminent engineers is not one step in advance from the primitive mole, the work of hands that had returned to dust before the British or the Roman name had been heard of. It is not the writer's intention to deny that improvements have been made, but so far as the main idea in the construction of breakwaters is concerned, it must be admitted on all hands that it was tumble-stone at the beginning and is tumble-stone to-day, excepting of course such a costly structure as Dover.

Nowhere has the daring of man been more visible than in his awful struggle with that most unstable yet most powerful of all agencies — water. To erect seaworks that stand at all against the terrific forces of sea-waves hurled in endless succession against them by a wind travelling at the rate of eighty and even a hundred miles an hour is an undertaking that might well shake the resolution of the boldest. Yet it has been done in all ages, and on almost every coast. History, that takes notice and hands down to future races the names of heroes who have been the scourges of mankind, has too frequently let drop into oblivion the names of the dauntless engineers who have by their mighty structures tamed even the ocean, and have offered to the shattered ship a refuge upon an exposed and inhospitable shore.

It may be well at this point to give a somewhat fuller description of the system of construction hitherto employed both by ancient and modern engineers before proceeding to consider in detail some of the typical breakwaters of the world.

As previously stated, large masses of tumble-stone or *pierre perdu* were tipped into the sea till the rubble mound reached the surface, where it acted as a shingly beach to receive the impact of the waves. The continued action of the waves gradually lowered the top of the mound and flattened the sea-slope. Consequently, the surface of the mound had to be continually fed with fresh material until the sea had worn it away into a natural slope. When this slope has at last been made, very little alteration takes place from the bottom to a point near low-water mark; but from thence upwards the mound is always liable to destruction or at least great injury, and as a consequence always remains a subject of great expense in order that it may be kept in efficient repair.

The celebrated Cherbourg breakwater was first formed in this manner, but as, after every storm, the sea left the mound reduced to low-water level and the harbour fully exposed to wind and wave, it became necessary to erect upon it as a basis the present magnificent superstructure. Our own Plymouth breakwater was similarly constructed, and was found to be equally unable to bear the action of the sea. Pitching, or facing with flat stones firmly set in cement, was resorted to, and with fair success. But when once any displacement takes place in regard to these surface stones, unless the breach be immediately repaired, the sea rapidly enlarges it, and would in a short while carry away the whole of the protecting surface, one wave being known to have ripped up as much as 70 ft. Another development of the tumble-stone system was the employment of concrete blocks for the formation of the mound at places where suitable stone was not to be obtained. Types of the concrete mound are the Biarritz breakwater, that at Leghorn, and the major portion of Port Said. The varieties of the tumble-stone system are too numerous to be fully gone into; but, as approximating most closely of them all to the system which will shortly be described, it will be well to mention the pile-driving system, by means of which the waste of the mound was to a considerable extent prevented. But whatever has been done by different engineers, many of them men of the greatest eminence, nothing would appear to have been discovered which supersedes the system of making a foundation of rubble or *pierre perdu*, and building upon it structures of stone or concrete. And, moreover, it may be said that whatever improvements the ingenuity of man has devised, in the way of building together these structures either with iron clamps or the dove-tailing of the stones one into another, they have all been failures in a greater or less degree; moreover, their cost has been tremendous, and, in the few instances where a fair amount of efficiency has been obtained, it has been gained at the cost of thirty or forty years of incessant labour, armies of men being employed daily in tipping vast quantities of material into the sea for the sea to arrange and re-arrange at its pleasure. The Cherbourg breakwater actually took seventy years in constructing, having been begun in 1783 and not finished until 1853. A very important point which must not be lost sight of is revealed by a casual glance at any of the diagrams representing the breakwaters referred to in this paper. It will be noticed that in order to secure a a basis for a superstructure of comparatively small dimensions it is necessary to encroach upon the waterway to the extent in some cases of at least ten times the basis required. Where the entrance to the port is sufficiently wide to allow of this encroachment the only thing to regret is the enormous waste of money and material incurred, but where the entrance is narrow it is clear that it puts an end to the possibility of building a breakwater at all, for by the time there was a sufficient basis formed for its erection there would not be left any waterway for ships to enter the port. It is owing to this important drawback that marine works have not been carried out in many of our principal ports, especially in the Colonies, which greatly require them.

It will scarcely be necessary in this paper for the author to go into the question of the varying forces of wave-power, nor into the theories of wave-action. It will only be necessary to take their results, which are certain and defined. But one thing it is very necessary to bear in mind, and that is, the well-known fact that a breaking wave exerts more percussive and destructive force than an unbroken one. It is also an admitted fact that waves begin to break when they enter a depth of water roughly approximating to their own height. It therefore follows that the very foundations of our present breakwaters, built on the talus or *pierre-perdu* system, are themselves unceasingly assisting in the destruction of their own superstructures. This was very forcibly brought out at one of the sittings of the Select Committee of the House of Commons on the Dover Pier Harbour Bill in 1875. The Chairman (Sir Seymour Fitzgerald) put question 1,676 to Captain E. K. Calver, R.N., as follows:—"The stability of an upright wall must depend upon the thickness of the wall?" and the witness answered, "It must depend upon the inertia of the mass and upon the profile. If you put a long batter on to a marine work, and create a wave, you bring into operation a power for its own ultimate destruction. On the details of construction I would not say a word; but upon matters of general design my experience is directly applicable." Further proof as to the inefficiency of the present system of construction may be obtained from the minutes of evidence taken before a Select Committee of the House of Commons on June 15, 1883. In question 1,513 Sir John Coode was asked if he was aware that the great drawback to the formation of, and great hindrance to, harbours hitherto has been the great failures that have taken place in harbour construction? Sir John replied, "I know that that has been a drawback, it has probably made the authorities timid in incurring a large expenditure." Question 1,514 was then put to him as follows:—"Are you aware that ten millions sterling have been expended by the Government mainly in what are called harbours of refuge, and that, excepting that magnificent work of yours, the Portland Breakwater, you may say that probably nearly the whole of the other harbours have been failures; for instance, Alderney?" Sir John replied, "Alderney has not been satisfactory, certainly."

As additional proof that the field is open for a new system of construction it may be well to quote the following paragraph from

* From a paper read before the Society of Engineers, on the 5th inst.

the appendix to the report of the Select Committee on Harbour Accommodation, July, 1884:—

"The next important point deserving of attention is the remarkable diversity of designs put forward by different engineers for sea harbour works, and the often defective results as regards outlay and failure in the works. This may be viewed as the result of long years of delay in carrying out harbour works, where the engineers who commenced seldom have lived to witness the completion of the works; and, consequently, the defects in any particular harbour have rarely been remedied in another one designed by the same engineer. We have no hesitation in stating that there is hardly a single harbour at home which will not show some defect worthy of being avoided in all future works; and a wasted outlay which must be burthensome to the nation."

It would be difficult to sum up the absolute inefficiency of the present system of breakwater construction more tersely than is done in the above paragraph by a body of experts appointed by the highest authority in the land as being the best men the country could find for the purpose. The Chairman of this same Committee read the following paragraph of a letter from Provost Rae referring to the disastrous failure at Wick,* "The unfortunate breakwater was an engineering experiment, and although a ruinous burden to Wick, it has been worth the money to the country in showing how *not* to do it again." Perhaps it is only fair to add that Provost Rae was writing with a view to getting the country to share the burden of the failure with Wick.

The author will now give a short sketch of some of the typical breakwaters of the world, beginning with some of the more ancient, and giving in connexion with each such details as may be of interest to the meeting, or may serve to illustrate the multifarious difficulties with which engineers have had to contend, and then proceed to describe a system by which it is hoped they may be successfully overcome.

One of the most ancient, if not actually the most ancient, breakwaters in the world is the famous mole of Famagousta, in Cyprus. It is formed of rubble-stone thrown loosely in. These stones weigh roughly between 2 or 3 cwt. each. The top is capped with a layer of squared stones averaging 3 ft. long and 18 in. wide, which are bedded and jointed in mortar. This top is now destroyed, and its *débris* has considerably narrowed the entrance. The difference in the ground-level on the sea side and harbour side is worth notice.

Another ancient breakwater which deserves mention is that at Civita Vecchia constructed by order of the Emperor Trajan about A.D. 100. From the account of it given by Pliny the Younger, it would appear that it was made in a very similar manner to that at Plymouth. That means to say, no progress in seventeen centuries.

Coming to modern breakwaters we have that at Alexandria, which has a depth of five fathoms and upwards, and shelters 1,400 acres. It was begun in 1870, and completed in two years. This remarkably short time in constructing a very large work was due to the enormous quantity of forced labour employed, and to the fact that there was no tide to contend against. The breakwater mole, quays, and other harbour works cost about 2,000,000*l.* The detached breakwater, which is 9,675 ft. long, is composed of concrete blocks which are 11½ ft. by 6½ ft. by 5 ft., and weigh 20 tons; they were kept for three months to harden before being employed upon the outside of the work, the inside of which is composed of rubble and large stones.

The Marseilles breakwater was begun in 1845 and took thirty-six years in construction, being finished in 1881. Its total length is 11,930 ft., its width 59 ft., depth 6½ to 12 fathoms. One portion cost 75*l.* 11s. per lineal foot; the portion opposite the Lazaret and Arene basins, 2,050 ft. long in a depth of 55½ ft., cost 109*l.* 14s. per ft., and the portion in front of the Maritime basin in a depth of 52 ft., and having a length of 1,660 ft., a similar sum. This structure is composed of a rubble foundation supporting placed masonry, faced seawards, with blocks of cement weighing from 20 to 30 tons.

The harbour at Algiers is protected by a rubble and concrete block breakwater of similar construction to those at Port Said, Biarritz, and Alexandria. It is perhaps unnecessary to remind this meeting that what stands very well in the tideless and fairly peaceful Mediterranean would probably prove worthless if exposed to the terrific forces of an Atlantic storm.

From an inspection of plans of harbours it will very readily be seen that the breakwater at Cherbourg is one of the largest marine works ever undertaken, and that it has not been exceeded as regards extent of area sheltered by any more modern works. The Alexandria Breakwater indeed approaches it in length, whilst the mattress jetties at Galveston and Charlestown even exceed it; but, considering the solid nature of the work, the powerful batteries which it supports, and the period of its construction, it must be admitted to be a marvellous monument of engineering skill and perseverance. It does not equal in depth and in section several other breakwaters, but it furnishes a perfect type of a breakwater formed of a rubble mound supporting a superstructure of concrete blocks and masonry starting from the low-water level. This famous breakwater was begun in 1778, stones being tipped in until high-water mark was reached. Waves and storms continually beat the top of the mound down to low-water level, the débris considerably enlarging the area of the tumble-stone foundation, while the sea action materially altered the shape it was intended to have taken by its engineers. In 1832 an upright wall was built on the top of the mound and the whole works were completed in 1853 at a cost of 2,674,491*l.* The superstructure successfully supplies the place of the weak part in the rubble mound and fulfils precisely the object for which it was designed, while the rubble is not carried higher than is just required for the protection of the foundation course of the upper works. Since the success of the system employed at the Cherbourg works has become known many other noteworthy and fairly successful structures have been similarly raised; but in some cases without allowing sufficient time for the settlement and changing of the mound before proceeding to raise the superstructure upon it. It is, perhaps, not surprising that but few engineers have the patience to wait thirty or forty years for their foundations to properly settle. With regard to the cost of Cherbourg it is only fair to state that the sum just named includes the cost for the foundation of the central battery and some other works not strictly incidental to the construction of the breakwater proper. M. Bonnin puts the actual cost of the breakwater at 2,000,000*l.*, which gives an average of 164*l.* per lineal foot.

A very fine specimen of the tumble-stone and superstructure formation is the famous breakwater at Colombo. Its foundations were laid in 1875. They are of tumble-stone or *pierre perdu*. It has a concrete block superstructure begun in 1874, the blocks being from 16 to 33 tons in weight, and were deposited diagonally by a steam Titan. During the "monsoon season," from May till October, the work had to be altogether suspended. In 1878, during a very severe south-west monsoon, a length of 150 ft. of the superstructure was considerably deflected. The maximum advance made with the works during any one month was in January, 1880, and amounted to 154 ft. The depth of water at the outer end of the structure is 6 fathoms. It is of interest to know that the breadth at the bottom of the wall is 26 ft., while at the top it is 24 ft., that is to say, the Colombo breakwater is a specimen of a nearly vertical breakwater, the great desideratum in such structures. When the harbour is completed the area sheltered will amount to 235 acres, having a depth of 20 ft. at low water, whilst the total acreage of sheltered water at low water will amount to 502. The concrete blocks of which the breakwater is composed are formed of 6 parts of broken stone, 2 parts of sea-sand, and 1 part of Portland cement.

It may here be mentioned that since the introduction of Portland cement for the formation of concrete, another very valuable auxiliary has been introduced into the building of sea-walls, breakwaters, &c., and there are already many other structures, besides Colombo, of considerable note in which this material has played a very successful part, in fact so successful has it been that it has now become an indispensable factor in the construction of all sea masonry.

The total length of the Colombo breakwater is 4,150 ft., its depth is 40 ft. The works averaged a cost of 170*l.* per lineal foot.

The first type of an English breakwater that will be considered is the well-known one at Plymouth. The famous admiral, Nelson's old chief, Lord St. Vincent, first proposed the formation of a breakwater here to Lord Howick, in 1806, when Lord Howick was First Lord of the Admiralty. But it was not until 1812 that Messrs. Rennie & Whidby's plan was adopted and the work begun. The mode of construction was by depositing in mid-channel large blocks of limestone obtained from a neighbouring quarry. These blocks were conveyed to the site for the breakwater in vessels of peculiar construction having openings in their stern out of which the stones were dropped to the bottom of the sea. In all fifty-three of these vessels, each being of fifty tons, were employed in conveying stone for the construction of the breakwater. From one of these vessels a load of fifty tons of material could be discharged in about three hours. In the course of 1812 the whole of this fleet discharged 16,045 tons of stone; in 1813 the amount discharged had risen to 71,198 tons; in 1814 to 239,480; in 1815 to 264,207 tons; while in 1816 it dropped to 206,033 tons. By the time this portion of the work was finished the sum total of the amount of limestone deposited reached the high figure of 1,000,000 tons. The proportionate dimensions of the deposited blocks were nearly as follows:—

Of 5 tons and upwards	12,760 tons
„ 3 to 5 tons	150,593 „
„ 1 to 3 tons	309,706 „
„ 1 ton and under	423,904 „

For quarrying this stone the sum of 2s. 5d. a ton was paid, while the charge for its carriage was about 1s. 10d. a ton. According to the most accurate calculations the cost of each ton of stone sunk for the construction of this breakwater was about 8s. 1½d.

The total estimate for the completion of this breakwater was originally 1,524,000*l.*, but the sums hitherto spent upon the work amount upon the whole to 1,562,639*l.* Mr. Rennie, the eminent engineer of the breakwater, died long before its completion. Plymouth breakwater, which is thrown right across the middle of the Sound, lies nearly due east and west; it stands completely isolated, having a channel half a mile in width on either side of it. It has also two wings, each being 350 yards long. The central part, which is straight, is 1,000 yards in length; the wings incline towards the north at an angle of 120 deg. from the straight portion. The breakwater stands 3 ft. above the level of the highest spring tide, is 120 yards broad at the base, 16 yards at the top, and has an average height of 14 yards. It has already been remarked that the mole at Civita Vecchia, built seventeen centuries ago, is constructed on almost a similar plan.

As will appear when describing Alderney, the cost for the maintenance of Plymouth breakwater amounts to the enormous sum of 5,000*l.* a year.

The works at Portland consist of an inner and outer breakwater. Early in the century a breakwater was suggested at this spot by a Mr. A. Lamb, and Mr. Idle, a local member of Parliament, entered warmly into the matter, and was the first subscriber to the necessary funds.* The area sheltered is 2,130 acres.

* Page 580, Commission of July, 1884.

* Lamb's Vindication is in the British Museum; a small pamphlet.

Although advocated at so early a date active work was not begun until 1847. The inner breakwater has a length of 1,700 ft., while the outer or detached breakwater extends to 6,400 ft. The work advanced at an average rate of 450 ft. a year. The total sum of money expended on it from the beginning until 1871 was 1,034,000*l.*, a sum equivalent to 127*l.* per lineal foot; but this amount does not appear to include the cost of convict labour.

Though the breakwater has had ample time to consolidate, and though the exposure is comparatively moderate, the slopes are still liable to injury from the action of the sea between high and low water levels. In both easterly and southerly gales the stones of the outer slope are displaced by the recoil of the waves, while under north-easterly gales the waves break right over mound and dash violently against the inner slope.

As much as from 500 to 3,000 tons of stone have been known to be disturbed during the continuance of a single gale.

The Harbour at Alderney is protected by a rubble mound supporting a superstructure founded below low-water mark. The depth of water varies from 21 ft. to 134 ft. at the outer end. The works were begun in 1847, were modified in 1849, and twice in 1858. The Western breakwater was carried out to a length of 4,380 ft. Its actual cost up to the period of completion in 1864 was at the rate of 235*l.* per lineal foot. It is worthy of note that from 1875 to 1883 the cost for repairs of breaches alone has amounted to the very large sum of 52,850*l.* This breakwater appears to have been strongly constructed in its upper and monolithic works, but to have been neglected in the matter of its rubble base. The large masonry blocks forming the outer wall are tied or "dowelled" together with huge bolts of gun-metal, while the rubble and dry masonry base is being continually worn away by attrition. The same defect is to be seen at Wick and Arklow also.

Sir Andrew Clarke, R.E., in giving evidence before a Select Committee of the House of Commons on the Harbour and Fortifications of Alderney (Session of 1872), reported that "the cost of Alderney had been 300,000*l.* less than the cost of Plymouth breakwater, which was being maintained at a cost of 5,000*l.* or 6,000*l.* a year, and he did not think that Alderney was likely to cost more." Not a very hopeful way of speaking of a breakwater which, when built at a vast expense, is supposed to be at least efficient. Breakwater construction must be in a very bad way when it appears to be a recognised thing that a finished structure should, as a matter of course, require 5,000*l.* a year to keep it in repair, such repairs being required so soon as the breakwater is supposed to be finished.

The Admiralty Pier at Dover is stone, built on a chalk basis, in a maximum depth of water at spring tide low water of 45 ft. This pier has a base of 92 ft., and a clear roadway of 30 ft. in width. Its sectional area is 4,736 square feet, and it cost 360*l.* per foot run. From a Government return of August 17, 1883, it would appear that the total cost reached 693,077*l.*; but in addition to that a sum of 22,827*l.* has been paid for repairing the damage done by a storm in 1877, and by others in subsequent years. The whole cost has been paid by Parliamentary grant. The original engineers of this magnificent structure were Messrs. Walker & Co., who were followed by Messrs. McClean & Stileman, and at a still later period by Mr. Edward Druce, C.E., who had previously acted as Resident Engineer.

Notwithstanding the immense cost and care bestowed upon this really excellent work it is said to now show signs of failure at the base. Dover is an example of a very expensive structure, in point of fact unequalled by any other breakwater construction in the world. Mentioning Dover brings prominently to mind the fact that the authorities themselves appear at length to have arrived at the same conclusion, and that they seem to be holding their hand awaiting some new development of engineering skill. For a long while Government has entertained the idea of building another breakwater at Dover in order to make it a harbour of refuge. Plans and estimates have been submitted during the past fifty years by such very eminent engineers as Mr. James Abernethy, Mr. Michael Scott, Mr. James M. Rendell, Mr. William Cubitt, Captain Vetch, R.E., Mr. Charles Vignolles, Lieut.-Col. Harry D. Jones, Sir John Rennie, and others. Yet not one of these plans has been considered suitable, and the matter still remains in abeyance, partly from the want of suitable material in the neighbourhood, partly from the great cost attending the preparation of foundations fit to support a superstructure capable of standing the action of the waves. The estimates which have been sent in vary from Colonel Jones's 1,100,000*l.* to Mr. Cubitt's 5,000,000*l.*

The breakwaters at Tynemouth are other instances of the destructive action of the sea, even at a depth of 12 ft. below low-water level, on small rubble supporting a high superstructure. These breakwaters, which are perhaps unequalled as monuments of engineering skill and perseverance, are formed of concrete blocks of peculiar shape built on shore and thoroughly well aired before being lowered by very powerful "Titans" (designed by Mr. Philip Messent) on to each breakwater, where they are set in position by divers. The operation is very slow and costly. The work was begun more than thirty-five years ago, and is not yet finished. Up to 1879 the north pier cost about 160*l.* per lineal foot, and the south pier about 75*l.* The north pier has a length of 2,900 ft. The breadth at the bottom is 52 ft. and 35 ft. at the top. Their height varies from 58 ft. to 61 ft. From time to time great damage has been wrought to their respective bases during heavy gales.

For the Holyhead breakwater an abundance of stone of excellent quality for the work was obtainable at the quarries on Holyhead mountain only about a mile off. The design adopted for the breakwater was that of a rubble base with a superstructure on the harbour side of the mound, springing from low water level, the building being a sea harbour wall of masonry composed of large blocks of stone set in lime mortar. This sea-wall not only provides an upper roadway or promenade at the top, which is 21¾ ft. above high water, but also shelters the quay level, which is 11¼ ft. below the upper level. The quay has been formed by the deposit of suitable small material on the mound above high water level between the sea and harbour walls. The breakwater has an average depth of 40 ft. and extends into a maximum depth of 55 ft. with a slope on the sea side of about 12 to 1 between high and low water, 5 to 1 from low water to a depth of about 12 ft., and about 2 to 1 from thence to the bottom. On the harbour side the slope is about 1¼ to 1 throughout. The total amount of stone in this stupendous mound is 7,000,000 tons. Holyhead breakwater was begun in 1849 and finished in 1873, at a cost of 1,285,050*l.* As the length is 7,860 ft. this gives 163*l.* 10*s.* as the cost per lineal foot. The cost of a bay of 30 ft. of the staging alone amounted to 586*l.* 10*s.* The charge for the maintenance of the mound has hitherto been very slight for the most part. At the extremity, however, the mound tends to travel round the head and is not quite stable. It has, therefore, been found necessary to protect the rubble slope for the last 200 ft. on the sea side near low water mark. This was first attempted by throwing down concrete blocks; but, as there was no adequate machinery for depositing the blocks, they got broken by the fall. Eventually old chains, amounting in weight to 1,000 tons, were placed in long coils upon the foreshore. By their weight these chains keep the foreshore from shifting, while, at the same time, they do not offer a solid face to the blow of the waves. A breach occurred in the breakwater last November by which some hundreds of tons of work had been displaced, and it is now very liable at any time to suffer considerable damage.

The breakwater at Wick is yet another example of the rubble base with block and concrete superstructure. It was begun in 1863, and in 1867 the pier had been advanced about 820 ft., while the rubble base was carried some 230 ft. further. The first material damage sustained occurred in December, 1868, when the outer portion of the superstructure was seriously damaged—the whole of the foundation up to a level varying from low water-mark to 10 ft. under it being uninjured—but the rubble base had, in some parts, been washed down to about 15 ft. under low water; in 1869 the damage had been repaired and reconstructed in cement, and in 1870 a severe storm occurred and a length of 380 ft. was damaged seriously. In 1871 about 30 ft. of the outer end was damaged; large blocks were built on the beach of cement rubble of from 70 to 100 tons each, and floated out by barges at high water, and deposited on the rubble base in advance of the proposed forward work. In 1872 further damage was sustained, and Mr. Rendel, being called upon to examine and report, attributed the failures of the work in 1868 and 70 to its want of "sufficient unity." In December of that year it was again attacked by a storm of great fierceness. Once more the storm in December, 1872, though not so disastrous from a pecuniary point of view as the storms previously experienced, was far more serious as regards the character of the damage done. The end of the work was protected by large blocks of 80 to 100 tons deposited as a foundation by three courses of large stones carefully set in cement, and the whole surmounted by a large monolith of cement rubble weighing upwards of 800 tons. This block was built in situ and, as a further precaution, iron rods of 3½ in. diameter had been fixed in the uppermost of the foundation courses of cement rubble, carried through the three courses of stone work by holes cut in the stone and finally embedded in the monolithic mass forming the upper portion of the pier. Yet the whole of this enormous work, weighing not less than 1,350 tons, succumbed to the force of the sea. During the course of the storm it was actually seen, from an adjacent cliff, to gradually slew round beneath the force of successive wave strokes until it finally tumbled over into the bay, where it has since rested.

Another example that will be taken of an existing breakwater is that of Aberdeen. This was begun in 1870 and finished in 1873. Its length is 1,050 ft., and it is 35 ft. wide at the head of the roadway, having a uniform batter of 1 in 8. The landward end for 500 ft. in length towards the sea is founded on rock, and the remainder on a bed of boulder clay, which had been covered with a thin layer of stones and sand. Of course the sand was cleared away in order to secure a solid foundation before the works were proceeded with. The manner in which the natural inequalities of the foundation were overcome was by levelling up with a deposit of concrete in small bags, on which blocks of Portland cement were built without being cemented. These blocks, weighing from ten to twenty tons, were carried up to a uniform level of 4 ft. 9 in. above low-water spring tides, except at the seaward end, where they were terminated at 9 in. above low-water spring tides. The blocks are composed of one measure of Portland cement, four measures of pit sand, and five measures of stones. The concrete superstructure, 18 ft. in height, was built over the blocks in frames, in situ, a large number of blocks being incorporated with it. The superstructure is composed of 1 measure of Portland cement, 3 measures pit-sand, and 5 measures of stone or shingle. An apron of concrete deposited in bags lies at the bottom along a part of the sea or east side of the foundation. It commences about 600 ft. from the shore, or about 100 ft. from the rock foundation, is then carried round the head of the breakwater, and returned along the harbour side for 110 ft. There are two rows of piles along the breakwater, placed at 18 ft. apart. Each pile is 2 ft. in diameter and

passes through the whole depth of the work. The piles are stepped into iron shoes at the foundations, and, where they pass through the substructure, are surrounded by blocks moulded to the form of the piles, the junction of the blocks being formed at the middle of the pile. The upper foundation courses of blocks have sustained damage along the whole length of the breakwater on the sea face, and along a part of the harbour face. The holes excavated in the upper courses have hitherto been repaired at low-water spring tides by filling up with small bags of concrete, and finishing the surface with a facing of Portland cement mortar. These patches have stood well, with the exception of the repairs at a point 500 ft. from the commencement of the breakwater. The breach at this point was further repaired during the summer of last year. These repairs, however, again gave way last winter, and the breach was enlarged by successive storms from the north-east to the dimensions noted in reports of February 6, March 10, and May 18. The survey made on February 6 showed the hole to be 22 ft. in length by 12 ft. deep, extending along one row of blocks, or 8 ft. into the breakwater; the survey of March 10 showed an increase to 72 ft. in length by a depth varying from 4 ft. to 12 ft., with part of the inner row of blocks removed; and on May 18 this breach formed a cavern 90 ft. in length by 12 ft. deep, and 23 ft. into the breakwater. On examination of the breach by divers, the foundation of small bags of concrete, on which the blocks rested, was found to be removed from under the blocks to the seaward of the hole for a length of 18 ft. The superstructure was split vertically 150 ft. along the middle of the breakwater over the hole, forming a separate mass of 2,500 tons weight, which rested as a flat arch entirely on the blocks at each end of the breach.

Mr. Smith, the resident engineer, explains this disaster as follows:—

"I am of opinion that the concentrated waves from the north-east, coming upon the junction of the rock foundation with the stratum of stones on boulder clay at this point, in a depth of 13 ft. at low water, swept out the concrete in small bags, relieving the concrete blocks from the weight of the superstructure. At low water the top of the breach was exposed to the air, the sudden compression of which, by the water flowing after the wave again covered the entrance, blew out by its explosive force the blocks on both the harbour and sea face of the breakwater."

The superstructure was also damaged on the sea-face close to the lighthouse tower, a breach being formed 54 ft. long by 22 ft. deep, and about 4 ft. into the breakwater. At a point on the sea face 100 ft. landward from the tower another breach was made, extending partly into the base of the superstructure and the upper course of blocks. The blocks composing the substructure are chipped and abraded on the sea-face, especially near the level of low-water. The piles where they pass through the superstructure have been eaten away by the sea-worm (*teredo navalis*), leaving spaces 2 ft. diameter between the blocks. The cost of repairs was estimated at 17,000*l.*

A great advance was made in the construction of breakwaters in the case of Wicklow Harbour Works. Mr. William George Strype, M.Inst. C.E., there adopted for the first time the bold method of erecting a sea-wall, in a very exposed position, by means of concrete entirely laid *in situ*. The following is Mr. Strype's own description of the method of construction as given in that gentleman's evidence before a Committee of the House of Commons:—

"We claim that the system we have adopted in the construction of the Wicklow works is a novel system. I have prepared a diagram that will show the Committee the system of construction that has been adopted there. In other ports, such as Newhaven, and I believe also in the exposed work at Fraserburgh, the part below water was laid by means of concrete in bags; the concrete is put in long bags contained in hopper barges. The hopper barge door is slipped, and the concrete bags drop to the bottom. These are piled upon each other and raise the structure to low-water mark. At Wicklow we adopted no such expedient as that, but in constructing the work we first formed a great central staging on which the engines, the waggons, and the cranes ran. That was extended in advance of the work to about half the length of the breakwater, and the staging trestles secured by means of a pad of concrete, which is shown upon figure No. 1. We deposit a pad of about 70 or 80 tons of concrete; No. 1 shows that pad. We carried the trestles thus secured by pads of concrete (as will be seen by the elevation) a long distance in advance of the general progress of the work. As soon as the staging was secured by this means, we deposited a great mound of concrete, which is shown in figure No. 2. Figure 2 shows the mound of concrete, representing about two-thirds of the volume of solid structure below low water. That great mound steadied the staging considerably, and also admitted of very rapid progress in the construction of the works. We were able during the construction of the mound to lay about 2,000 tons a week, and for a little work that is considered a very remarkable pace at which to lay concrete. Upon the mound we added an outside deposit of concrete to the form of the breakwater, as shown by figure No. 3, by means of a panel rendered heavy so as to make it sink. We raised this deposit to within 3 ft. of low water line. The difficulty with this system of construction is more when you get near to the level of low water. At low water the disturbing waves are apt to wash the cement out of the concrete before it is set. By putting our first stretch of panel within 3 ft. of low water we are able to deposit or form the first profile too, as shown in fig. No. 3, to within 3 ft. of low water. As soon as that sets, which it does in a day or two, as shown in fig. No. 4, we put a panel from that above the level of high water, and then lay a further portion of the profile. For that further portion we select very calm water, so as to avoid disturbance of the work. That is the most trying part of the work while the structure is being formed, as shown in fig. No. 4. We carry up the inside to the height of low water. As shown in fig. No. 5, the work being over low water mark is quite easy, and figure No. 6 shows simply the building of superstructure, which can be readily accomplished. The volume of the breakwater is about forty cubic yards per foot run, and the cost of the work which we paid is 17*s.* 3*d.* per cube yard, so that it comes to under 40*l.* I am satisfied we could carry out this work in water 50 ft. deep, by making modifications in the system. We found the least loss of timber and the least loss of concrete in every part of the work until we got within 3 ft. of low water. Up to 3 ft. of low water no trouble existed; we never lost a single cubic yard of concrete in that lower work, and the work was frequently visited by storms, and we frequently deposited concrete with a wave of 3 ft. undulation."

The author thinks that without wearying the meeting with any further examples (many more could easily be cited), a sufficient case has been established to show that the present system of breakwater construction is thoroughly inefficient. Even with the most generous exchequer to carry out designs and plans in the future he maintains that both money and time will be again spent in vain, and that fresh failures will result, unless a totally different system of construction be adopted.*

NOTES.

THE Railway Rates Inquiry terminated quietly last week,—so far as the examination of witnesses is concerned,—and the recommendations of the Commissioners will now be awaited with interest. Evidence was taken at the concluding sitting concerning a number of articles which had been reserved for further consideration,—a curious medley, comprising hay and straw, flowers and fruit, hardware (in detail), and telegraph wire and poles. There have been eighty-five sittings in all,—so that the inquiry has occupied just about two-thirds as many days as did the Parnell Commission; and Lord Balfour of Burleigh and his colleague, Mr. Courtenay Boyle, have conducted it throughout in a most praiseworthy manner. It was once remarked of a Colonial Railway Commission that "the real value of the Railway Commissioners to the country depends on their ability to free the department from the trammels of 'use and wont,' and to conduct its affairs on common-sense and business lines." In this country "use and wont" in railway administration represents the result of long experience, our railways being happily free from the red-tapeism which would probably have fettered them had they not been the outcome of independent enterprise. Still, there is room for expansion and reform in some directions, and there is the possibility of "precedent" being too slavishly respected; and this Inquiry affords scope for selecting and adopting the best of the various suggestions offered, even though such a step may be somewhat of a departure from the old lines. It is too much to expect the result to be satisfactory to everybody, but we hope that the Commissioners' decisions will, in the main, commend themselves to the business instincts of the commercial community.

ALMOST an entire sitting of the London County Council last week was occupied by an academic discussion of the licensing proposals of the Government contained in their new Budget and Local Government Bill. The discussion was made on a motion by Sir T. Farrer, condemning the proposals, and asking for a petition to be presented against them. Such waste of time as this is lamentable. The Council is essentially an administrative body, and it is absurd to have a kind of second-hand Parliamentary debate on a question which not only affects the whole country, but is one of more interest to the small towns and rural districts of England than to the Metropolis. All moderate men desire to see the London County Council carry out their work with success, and it is, therefore, grievous to know that by such debating-society talk as this the Council discredits itself, and weakens its authority and position.

THE last issue of the "Antike Denkmäler" of the Berlin Archæological Institute completes the first volume of the new series. It contains two plates, with accompanying text, of special interest to architects. The first of these is devoted to plans of the Cloaca Maxima, from the Forum Augustum to where it falls into the Tiber. To this work we have already referred. How little has been up to this time known definitely of this Cloaca may be seen by a comparison of the present plan with the account in "Jordan's Topography of Rome," I., i., p. 447. The Institute owes the plan to Signor Narducci, and its previous publication has been prevented owing to a scheme for publishing collectively the whole drainage system of Rome, from ancient down to modern times. As the Cloaca Maxima is of special importance for the study of ancient topography, archæologists will welcome this separate issue. The second plate (38) contains coloured facsimiles of archaic achitectural fragments, in which distinct traces of colour remain. They are fragments attributed to the archaic Temple of Athene in the Acropolis. The lion heads, which serve as spouts, are crudely coloured—the hair blue, the eyes a bright emerald green. They are clearly analogous in style to the lion head spouts of the Temple of Zeus, at Olympia. The third plate gives the most beautiful reproduction we have yet seen of one of the most richly painted of the archaic Acropolis statues. How difficult it is adequately to reproduce the delicate yet rich effects of this colouring may be seen in the disastrous recent attempts of the "Ephemeris." Plates 44-46 should be of interest in England, as, among other fragments of painted terra-cotta sarcophagi, they reproduce some that are now in the British Museum. These Clazomenæ sarcophagi, which have excited so much attention, are now divided between museums at Constantinople, Smyrna, Berlin, Vienna, and London, so that to bring them together is of great advantage.

DR. WALDSTEIN'S third lecture on recent excavations in Greece, delivered at the Royal Institution on Saturday last, was the most interesting of the three, and it is not often that so much of history and so much of "higher criticism" is condensed into an hour's lecture. The lecturer gave a short

* To be continued.

but admirably-expressed criticism on the distinction between the characteristics of the art of the great Attic period and that of the later period and of the Græco-Roman school: the former showing that precision and distinctness of aim and idea which belonged to a complete school, and especially the clear perception of the relation between the subject and the means of execution: while in the later schools we found attempts to give to sculpture an expression and a treatment essentially pictorial. The latter part of the lecture was occupied with a brief review of the work done in recent years in Greek exploration; but the point of most interest in the lecture, as referring to a great future chance of discoveries as yet almost unattempted, was in regard to the work which might be accomplished on "Delphi's sacred side," if only the required funds were forthcoming. The site of Delphi is now built over by the village of Kastri, and the Greek Government has very rightly made it a condition of granting powers to excavate there that whoever undertakes the work shall find funds for fully compensating the expropriated inhabitants, or providing them other residences. Under these conditions it is estimated that it would be useless to commence the work unless 20,000*l.* were first collected towards it. The American School at Athens has the claim to the concession up to October of this year, and if they are not by that time in possession of the necessary funds, we gather that the concession will be open to other claimants who may be able to provide funds. There may be a chance in that case of England, either through her Government or through some wealthy Englishman or group of Englishmen, doing something to recover the ground which she has rather lost of late years in the honours of successful exploration. The attempt would be well worth an exceptional effort. As Dr. Waldstein observes, what might not be found at Delphi?

THERE has recently been published a little pamphlet called "'On Principle' Strikes," by Mr. J. S. Ransome, containing four sketches which originally appeared in the *Globe*. The author does not improve his chance of success by a title which at first sight puzzles rather than enlightens the reader. But the publication is nevertheless apposite; its object is "to point out how little the real interests of the working-man are studied by the leaders of the present-day unions." In order to do this, sketches are given of typical persons engaged in strikes. The third sketch is that of "The Shop Lawyer,"—in other words, the talking leader, who gradually stirs up discontent, and then gets the men to come out on strike. In this, as in the other sketches, there is a good deal of truth; but, like many sketches with the brush, these with the pen are somewhat over-coloured. Yet this is in many ways just the kind of literature to bring home some truths to the mind of the working-man. The "shop lawyer," whose object is to help himself personally as much as to assist his fellow-workmen, and who hopes to turn into a salaried Trades Union delegate sooner or later, has done much harm; and the general body of workmen is too much under the control of a despotism of Trades Union officials. Mr. Ransome's sketches will expose the true character of some of the persons engaged in strikes, and cannot fail to do good.

THE current volume (Vol. XCIX.) of the "Minutes of Proceedings of the Institution of Civil Engineers" contains an interesting paper on "The Water-supply of some Italian towns," by Mr. A. F. Bruce, Assoc.M. Inst. C.E. The author states that the city of Venice was for a long time entirely dependent for water-supply on the rain which fell within its own area, collected in cisterns in the piazzas and courts. This being found inadequate, in the sixteenth century the Seriola Veneta Canal was constructed, the water being brought thence into the city by means of boats. As time wore on, this source too was found to be insufficient, and in 1883 the new works were finished, which now form the main supply of the city. These consist of a number of comparatively shallow artesian wells sunk into a water-bearing stratum, near the village of S. Ambrogio. The supply pipe is capable of delivering 3,000,000 gallons per day, or twenty-two gallons per head, which the author says is nearly three times the quantity considered sufficient in Venice. Filter beds have also been constructed at Moranzani in order to utilise the water of the Seriola, if required. Genoa was entirely dependent on its own internal resources for water-supply until, in the fifteenth century, the Government "constructed a masonry aqueduct, which conveys the water of the Bisagno from a point ten miles from the city and 500 ft. above the sea; its tributary, the Concasca, was afterwards connected by a branch." This aqueduct is still utilised, though its dilapidated condition permits the escape of considerable quantities of water along the route. Mr. Bruce estimates that of the 4,000,000 gallons admitted daily, only about 3,000,000 gallons actually reach Genoa, and owing to the aqueduct being partly open (and to other causes) fruitful sources of pollution are created. About twenty years ago an additional supply was obtained from the River Scrivia, near Busalla, by means of an infiltration gallery, which is said to be able to deliver nearly 12,000,000 gallons daily. The works of the Gorzente or Deferrari-Galliera Company are of still more recent date. "They have their source at the Torrent Gorzente to the west of Genoa, where there is a storage reservoir holding about 220,000,000 gallons." About 13,000,000 gallons daily are capable of being delivered. In addition to these sources, an English company has commenced to make works in Genoa, which, when finished, are expected to yield another 4,000,000 gallons daily from the Bisagno and Concasca basins. Rome is said to have inherited from the most ancient times the best water supply in Italy. At present the city "receives water from four aqueducts; three of these are of great antiquity—namely, the Vergine, Felice, and Paolo; and from a more modern, or rather an old work resuscitated, called the Acqua Marcia or Pia Aqueduct." The three former yield nearly 34,000,000 gallons daily, whilst the latter is capable of delivering 19,750,000 gallons, together making about 200 gallons per head, which is truly an enormous quantity. Most of the houses have cisterns containing 400 to 500 gallons. Leghorn derives its water from an old aqueduct from Pisan Hills, which only delivers 3·20 gallons per head per day. Turin merely gets a daily allowance of 6·75 gallons per head, whilst Florence has about 20 gallons, and Naples 44 gallons. The author says that "work can be done in Italy at prices which, with the exception of ironwork, are considerably below those ruling in Great Britain, owing chiefly to the cheapness of labour; a mason receives about 3s., a quarryman 2s. 3d., and a navvy 2s. per day. . . . . Good hydraulic rubble masonry can be built for 8s. 6d. to 12s. per cubic yard; ordinary excavation costs about 8d.; rock, 1s. 6d. to 2s.; and tunnelling, 3s. to 4s. per cubic yard." Perhaps the most striking part of Mr. Bruce's paper is the table at the end, showing the sources of supply of the chief towns in Italy, the quantity of water supplied, cost of works, &c. It seems almost incredible that civilised communities like those of Leghorn, Turin, and many minor places can put up with such comparatively small supplies as from 3·20 gallons to 6 or 7 gallons per head per day, especially when we consider the nature of the climate. Yet such is the case, and bearing in mind the fact that in many large towns the drainage is also very imperfect, it is not to be wondered that the "fair cities of the south" are not always as salubrious and health-giving as they might be. Without an adequate and wholesome water-supply and efficient drainage, it is impossible to successfully cope with the zymotic and other diseases which so often appear in towns along the borders of the Mediterranean, impeding commerce, and dealing destruction and desolation on all sides. When will the people be sufficiently educated to perceive this?

IN looking through a list of some sixty reports on technical matters sent in to the Ministry of Public Works of Berlin, by the six technical attachés of the different Embassies at Vienna, Paris, Rome, St. Petersburg, Washington, and London, we find that Great Britain has been treated by far the worst, the attaché stationed here having only sent in two* papers as against twenty-two sent in on French affairs, and the fourteen and twelve sent in respectively from America and Russia. We do not know if there be a dearth of material for technical reports on our Island, which has caused this minimum quantity of "report," or if the fault perhaps is to be found somewhere else; but it appears that the authorities at Berlin do not consider the English post worth its cost, and have made known their intention of withdrawing it,—a great pity, we venture to say, as it is quite certain the right man might be able still to find a thing or two in the country which would interest his countrymen.

IN October last an international competition was opened at Lausanne for a collection of buildings in which the public library of the Canton, the academy, assembly rooms for scientific purposes, and halls for several collections were to be placed; the site chosen for this erection being a most ideal one, situated on an incline, topped by the cathedral and overlooking the Gulf of Geneva. The "programme," which was compiled in a most thorough way by an international jury which was elected especially for the purpose, showed that three prizes of 12,000, 8,000, and 5,000 francs were to be given away, and that the amount at the disposal of the Town Council for the carrying out of the project was 3,000,000 francs. The members of the jury were Professor Auer, of Bern; the architect of the New Law Courts at Leipsic, Regierungs-Baumeister Ludwig Hoffmann; Professor Lassius, of Zürich; the City Architect of Lyon, M. Hirsch; and the architect of the new Sorbonne at Paris, M. Nénot. On the 22nd inst. the jury came to the unanimous conclusion that none of the designs merited the first prize; that the second should, however, be awarded to M. André, of Lyon, and the third to M. Demierre, of Paris, whilst the 12,000 francs due to a first prizeman should be divided among the owners of the four designs next in order of merit. These four designs were by Messrs. Legrand & Leroy, Paris; Kuder & Mueller, Strassburg; Recordon, Lausanne; and Hadberg, Berlin.

THE picturesque old town of Hildesheim is undergoing changes which may be necessary from the inhabitants' point of view, but some of which will probably be regretted by visitors. It appears that an extensive restoration is going on among the old timber houses so abundant in the town; and an entire renovation of the old "Rathhaus" is being gone through, the new decoration of the great hall, with its timber roof, its interesting woodwork, its frescoes (which are still being worked at), and the Town Council's room, with the adjacent Mayor's study, being especially remarkable. Among the public buildings completed within the last few years, the new railway station and the new post-office, both of brick, may both be considered worthy of note, and among those still in course of erection, the public slaughter-house is certainly worth a visit. The rebuilding of the Government House (Regierung) is perhaps the most interesting work at present being done in the town, not only on account of this building showing a practical plan and some interesting German

* One on hospitals for infectious diseases; the other on the burning of the petroleum ship *United* in Bremen Harbour.

Renaissance elevations, but also on account of the rebuilding being cleverly carried out in three portions, one after the other, without materially disturbing the business routine of the house. This building, the west gable of which is one of the few pieces of architecture bearing the "F. III." of the deceased Emperor Frederic (who reigned ninety days), is now nearing its completion, and will, when finished, cover some 25,000 square mètres of ground, having cost nearly 35,000*l*. Among the new private houses which are unhappily finding their way in between the picturesque old ones are several fine shops and a new hotel.

THAT unique little capital, Brunswick, in which one finds the picturesque old work, the palatial Renaissance of the public buildings, and the work of the present day so well blended together, now boasts of a restoration of the main part of the old "Burg Dankwarderode," the castle hall of which, finely situated in close proximity to the Dom, showing a strict German Romanesque exterior, has been pretty well entirely rebuilt, and is now nearing its completion. Among the public buildings of the town finished during the last few years the New Museum is certainly worth mentioning, especially on account of the good planning of the whole, and the picture-gallery in particular, and the monumental design of the façades; whilst among those buildings still on paper the new "Stadthaus" and the new railway-station may be noted, especially the latter, which is now under consideration, and for which much preliminary work will have to be done before a decision can be arrived at.

THE alterations which are to be carried out by Mr. Rowland Plumbe at the London Hospital, by the recommendation of Dr. Louis Parkes, extend to a complete remodelling of the sanitary arrangements, at an estimated cost of 7,000*l*. New drains are to be laid, the present imperfect soil and waste pipes, sinks, &c., removed, and two turret blocks, cut off from the wards and bedrooms by ventilated corridors, will be built upon advanced hygienic principles for the general purposes of the hospital. The new buildings comprise a central block, 80 ft. wide, and projecting 50 ft. towards the road, thus affording a covered approach for vehicles from the street. Medical baths, store-rooms, and students' lavatories will be fitted in the basement, and on either side a students' waiting room, with rooms for the nurses and for patients on reception and examination. The chapel, on the first floor, will give place to a new operating theatre, capacious enough for 250 students, standing on platforms ranged in form of an amphitheatre. This theatre is to be two floors in height, lighted and ventilated in the roof, and will be supplemented by a new theatre, 40 ft. by 23 ft., for clinical instruction, to receive 150 students. This hospital was built in 1752; it has been considerably enlarged from time to time,—by a south-west wing for 100 beds in 1830; in 1840 by a south-east wing for seventy-four beds, reserved to Jews; and by the "Alexandra" wing, for seventy beds, in 1864; and, in 1876, by the "Grocers'" wing, opened by the Queen, the accommodation being thus raised to a total of 776 beds.

PLAS NEWYDD, close to and overlooking Llangollen, is about to be put up for sale by auction. A residence of the late General Yorke, C.B., who largely added thereto, the original cottage was built in 1778 by Lady Eleanor Butler and the Hon. Sarah Ponsonby. Their retirement here, as the "Ladies of Llangollen," has been described by Madame de Genlis. Dying in 1829 and 1831 respectively, they are buried in the parish churchyard. The cottage was next tenanted by their no less eccentric imitators, Miss Andrews and Miss Lolly. This property, which covers about 11 acres, is situated near to the Cistercian Abbey of Valle Crucis, and the well-known vale of the river Dee; it includes another house, newly built in the same style as that of Plas Newydd.

A ROOM at Messrs. Dowdeswell's is now devoted to an interesting exhibition of Indo-Persian pictures and manuscripts. There are only a few manuscripts, the majority of the exhibits being pictures, chiefly portraits and figure subjects. Many of these are marvels of careful draughtsmanship and detail, and the borders of gold and colour, which in a few cases surround them, are very fine, particularly beautiful examples being (2), (17), and (28a). Others are mounted on a sort of marbled paper touched up, or rather powdered, with gold. Although good in themselves, they rather detract from the importance of the portraits, none of which are on a large scale. The clever way in which large masses of figures are grouped is well shown in (16) a "Fight on the Banks of a River," and again in one of the manuscripts (2) illustrating the wars of Mahomet. There are a few strictly architectural subjects in the collection, the best being (5) "The Iron Pillar," a view looking across the court of the mosque of Kulbul Islam; (15) "The Tomb of Shekh Salím, at Fathpúr Sikri," the white marble of the tomb contrasting well with the warm colouring of the pavement and surrounding buildings; and (35) a careful drawing of the Emperor Humáyan's tomb, with the Jumma river in the background,—the warm, clear atmosphere very skilfully suggested without an appearance of hardness. The view of Mecca (89) suffers from bad perspective, and both it and 73 are poorer in colour than those already noted; 31 has a richly decorated architectural background, but most of the backgrounds to the figure subjects are treated in a simpler manner, the decorative detail being lavished on the costumes and the carpets on which the figures are seated. From a decorative point of view, in fact, the exhibition has its chief interest.

SANITARY CONGRESS AT LEAMINGTON.

ON Saturday last a large number of the members of the Association of Public Sanitary Inspectors of Great Britain attended the fifth provincial congress of their body, Leamington being the town selected for the meeting this year.

The proceedings commenced in the Town-hall, where, at 11 o'clock, the Mayor (Mr. John Fell, a well-known builder and contractor,) received and welcomed the visitors. It was not long ago, he said, when anybody could get an appointment as sanitary inspector. Sometimes army pensioners were found occupying the position, although they had absolutely no knowledge of the science required by the post which they filled. They had absolutely no idea of the importance of the duties they undertook, and did not realise their responsibilities. It was only when this Association and others like it began to be formed that sanitary science took its proper place, and the general public began to recognise the important status of sanitary inspectors; and no doubt they would shortly be recognised as a very much more important and influential body than they were regarded as being at the present time. It was certain that in trying to raise the dignity of their profession the general public would back them up.

The Mayor then left the chair, and in the absence of Sir Edwin Chadwick, President of the Association, Mr. Hugh Alexander, Chairman of the Council, presided for the remainder of the meeting.

Mr. Alexander, after thanking the Mayor for his hearty welcome, expressed the hope that he would find an opportunity of enunciating in the House of Commons his views on the importance of sanitary improvements. The Association had made great strides since its formation in 1883, having now 500 members, and it had accomplished a great work in the interests of public health. No body of men knew more about the requirements of sanitary science than sanitary inspectors. Among the things they had done was to propose a deputation to the President of the Local Government Board. Mr. Ritchie, however, preferred to have their views in writing, and the Council had submitted them. The Council, in their report, stated that the conditions under which sanitary inspectors were appointed were inimical to the interests of the public health, these conditions being due to the defective state of the sanitary law in the following particulars:—(1) That there is no statutory definition of the qualifications of candidates for the position of sanitary inspectors; (2) that there is no satisfactory provision as to tenure of office; (3) that inspectors are not empowered to initiate proceedings by serving notices for the abatement of nuisances, however urgent they may be; (4) that there is no prescriptive minimum salary; (5) that the officers employed are not uniformly designated. The Council found that the first four of these defects originated in the Nuisance Removal Act of 1855; that they have not been remedied by any of the numerous amendments to that enactment; that, on the contrary, they have been reproduced in the Public Health Act of 1875, and that in many districts they constitute a permanent hindrance to sanitary inspectors in the discharge of their duty to the public. The Council therefore recommended that the influence of the Association should be directed to secure the following amendments in the sanitary law:—(1) That every candidate for the position of sanitary inspector should have a general knowledge of the building trade, and, in addition, should possess a certificate in sanitary science; (2) that sanitary inspectors should be elected to a permanent tenure of office, and should only be removed for misconduct or proved incompetence, with a right to appeal to the Local Government Board; (3) that it should be the duty of sanitary inspectors to periodically inspect the dwellings of the district to which they are appointed, and to receive complaints of nuisances, and serve notices forthwith, require all necessary work to be done for the abatement of the nuisances, such notices to be as valid as though served by the local authority's order; (4) that in all appointments requiring the officer's whole time to be given to the duties of his office, an adequate minimum salary should be prescribed; (5) that the officers, now variously named sanitary inspectors and inspectors of nuisances, be designated sanitary inspectors. No doubt, the Chairman went on, these recommendations had been pigeon-holed, but when the position of sanitary inspectors came to be considered by the Local Government Board, the views submitted in writing would have good effect.

Sir Edwin Chadwick, the venerable President of the Association, who wrote regretting his inability to attend the Conference, also contributed a paper (read for him by Sir Douglas Galton). In it the author urged the necessity for improved measures for the sanitary welfare of the police. In London the men were compelled, by small wages, to live in unhealthy houses, and Sir Edwin advocated the provision of model dwellings on a large scale for their accommodation, maintaining that this could be economically done. He also referred to the use of machinery for cheap washing with tepid water, and its successful introduction in the German and French armies. The cost of washing 100 men with tepid water in France by Mr. W. Bartholomew's "improved jets, up as well as down," is about 4½d. Turning to the necessity for good sanitary inspection, Sir Edwin said the chief obstacle to securing it was the inadequate pay given to inspectors generally, and incompetence to apply the necessary mechanical improvements. He emphasised the necessity for establishing a central authority on matters relating to health and sanitation—an agency for collecting for its own guidance, and communicating to each local authority for its guidance, the principles deduced from the experience of all other places from which information might be obtained; and in conclusion said that to secure such a central authority, a Minister who could guide and direct sanitation in all its departments was necessary, and an object towards which every sanitarian should strive. The fact that a Minister of Agriculture had been appointed should only render them all the more determined to add to the Cabinet a Minister of Health. To them, as sanitary men, in the most practical of practical senses, the appointment was vital. They and their labours would never be understood until they had such an official exponent of what they were and what they did in one of the houses of Legislature, and he urged them to organise and agitate for this much-demanded public department until the thing was done. It must some day be done, and for the Association to take a

prominent part in the struggle to get it done would be a lasting honour, and a further surety of continued respect and prosperity.

Sir Douglas Galton read a paper on "The influence of recent legislation upon the duties of sanitary inspectors." He said this was a very appropriate time for considering certain questions relating to the status of inspectors and their functions in connexion with the wide attention which had been given to sanitary work in consequence of the passing of many Acts of Parliament. It was to be regretted that some of the recent Acts obtained by local authorities appeared to be directed to the regulation of small details of construction or management, rather than to lay down general principles. These details would more advantageously have been embodied in by-laws, as they could then more easily be varied to suit the requirements of particular districts. What would seem to be required was that there should be a new general Act of Parliament, embodying the principles of the Act of 1875 and subsequent Acts, and further enabling rural and urban authorities to give effect to them by means of by-laws dealing with details, which might be revoked or altered to suit requirements as they arose. When the scheme of decentralised local government was complete the County Council should settle the by-laws for each district. The advantage of legislating by means of by-laws was that it was necessary that the sanitation of the country should keep pace with increasing scientific knowledge and the improved education of the community in their knowledge of the laws of health. Their acquaintance with the causes of epidemic disease was daily widening, and as the people were becoming better informed upon sanitary questions the arrangements which were essential to-day would be found antiquated and insufficient in a few years. The subject connected with public health which had most frequently engaged the attention of Parliament during the last thirty or forty years was that of the housing of the poor, no fewer than thirteen Acts having been passed in that time. The laws were now sufficient, if they were duly enforced, to prevent the more wretched class of house property from being occupied, but there were some potent causes operating to prevent the full application of the law. In some cases the owners of the bad property themselves held positions in connexion with Vestries or on Local Boards or the bench of magistrates, which enabled them to prevent the enforcement of the Act. There were other cases in which the Medical Officer hesitated to carry out the law because the persons turned out would have no place to take refuge in, and in such cases it was difficult to avoid the conclusion that if the law as to sanitary dwellings was to be fully enforced the local authority must step in in some form or other. Probably the best form of relief would be the provision of common lodging-houses on the Glasgow principle, with separate sleeping accommodation, but the use in common of the cooking, eating, and washing places for a small payment. This accommodation should be wholesome, but intended only as a temporary refuge, and such as would induce the occupants to find suitable dwellings elsewhere; and where such lodging-houses were provided, the Acts of Parliament against insanitary dwellings should be most stringently enforced. The provision of water for the purposes of drinking and cleanliness had also been before Parliament several times. The Rivers Pollution Act was the most important of eleven passed during the past forty years, but it had never been adequately enforced. Streams and water-courses were still being polluted by refuse of various kinds, but very scanty efforts were made to prevent the evil. Manufacturers treated the rivers worst, and many streams had been allowed to become no better than foul sewers. On these two questions—the housing of the poor and the purifying of our water-courses—practical action was urgently needed. Another important matter was the compulsory notification of infectious diseases. The few local authorities that had decided to adopt the recent Act were governed by good sense. Its general adoption must necessarily lead to more systematic treatment of disease. Turning to the Local Government Act, 1888, which created the County Councils, he said it made an important advance towards systematising the sanitary administration throughout the country. Of the importance of bringing the sanitary administration of the counties to a focus there could be no doubt. It might be said that as a rule the towns were well administered, but if they examined the Registrar-General's returns they would see that, while the death-rates of the urban populations had decidedly diminished within the past fifteen years, the death-rate of rural populations had remained stationary; and yet a large proportion of that rural death-rate arose from zymotic or preventible disease. The diminished rate in towns was the result of the careful system of sanitary administration, whilst the stagnant condition of things in the rural districts was mainly due to an absence of desire for good administration. The owners of property, often members of sanitary boards, had not encouraged the sanitary inspectors to bring forward cases of defective water-supply, or the prevalence of any other insanitary conditions which would involve them in expense, and it was upon this account that he looked upon the provisions of the Local Government Act as a most important advance. It empowered the Councils to appoint Medical Officers of Health, who would study the reports sent in by the district officers of health, and be able to advise what steps should be taken for preventing the pollution of streams, and, where necessary, for compelling local sanitary authorities to enforce the Public Health Acts. With the increased vigilance then enforced on all public bodies, the functions of the sanitary inspector would extend, and in proportion as the public were better educated in the laws of health, so would his duties become more onerous. He also desired to say a few words as to the qualifications of inspectors. He had had some opportunity of considering this question in connexion with the examinations held by the Sanitary Institute, which had passed hundreds of candidates. They had been asked to embrace in the examination a knowledge of building. When they looked at the large number of subjects which constituted the special business of the sanitary inspector, and which he should know thoroughly, he doubted the wisdom of requiring him to learn matters which more properly appertained to the duties of a clerk of works or Borough Surveyor. The subjects on which he must have sound knowledge were so extremely important, and in the cases of many of those who presented themselves for examination had been so little mastered, that he hesitated for the present to extend the examination to any subjects which would divert attention from more essential studies. With the recommendations of the Council as to securing stability in their appointments, remuneration, and retirement, he thoroughly agreed. Their position and duties were most important. They were the duties of the practical prevention of disease. The inspectors had access to every household, and they could point out beneficially many matters of insanitation before they had culminated in the production of fever or some other danger to health. If they performed these duties earnestly, strictly, and honourably, they would help to educate the public in sanitary knowledge, and thus obtain the esteem and retain the confidence of the public.

Subsequently, Mr. W. de Normanville, C.E., the Borough Engineer, read a short paper describing the sanitary arrangements of Leamington, and the visitors during the day inspected the waterworks and the sewage works.

The English Iron Trade.—As was to be expected, business in the English iron trade is as yet very quiet after the holidays, and the market has not gained in strength. There has only been sparse buying of pig-iron, and, where any orders are taken, they are at lower figures than those quoted by manufacturers. There is very little demand for Scotch makers' iron, which is irregular in price. The hematite market in the North-west looks, on the whole, more cheerful. Although hematite warrants are 9d. a ton lower compared with last week, makers are holding more firmly to their present quotation of 57s., while a week ago they were selling,—in isolated instances it is true,—at 54s. Manufactured iron is still dull, and prices are again lower. Steel has somewhat improved as regards inquiry, but values do not rise, the tendency being still the other way. Shipbuilders are booking a few fresh orders, but the general situation remains unchanged. The same may be said of the engineering trade.—*Iron*.

Illustrations.

PEVEREY, SHROPSHIRE.

THIS house is being erected for Sir Offley Wakeman, Bart., on an estate near Baschurch, and is being built of local red sandstone and English oak, and covered with green Westmoreland slates, the chimneys being partly brick and partly stone.

The house contains on the ground-floor large living-hall, out of which open drawing- and morning-rooms, boudoir and billiard-rooms, and a small private chapel. Beyond is a business room, and the usual housekeeper's-rooms and kitchen offices, and, in addition to the principal and servants' stairs, there is also one for the family use, the staircases and principal rooms being finished in wainscot.

On the upper floors are some thirty bedrooms, grouped together for the convenient accommodation of guests, the family and nurseries, the men-servants, maid-servants, and stranger-servants.

The garden front, with terrace, faces nearly due south; the stables lie to the north-east, and the kitchen-gardens to the west; the main entrance being on the north, and the family one on the south.

A long, low stone house has been aimed at, with some half-timber work on the south front only.

The builder is Mr. John Bentley, of Waltham Abbey, Essex; and the clerk of works Mr. Unwin.

The gardens and grounds are being laid out by Mr. H. E. Milner

The drawings illustrating the house are hung at the Royal Academy. Mr. Aston Webb is the architect.

LEEDS AND COUNTY LIBERAL CLUB

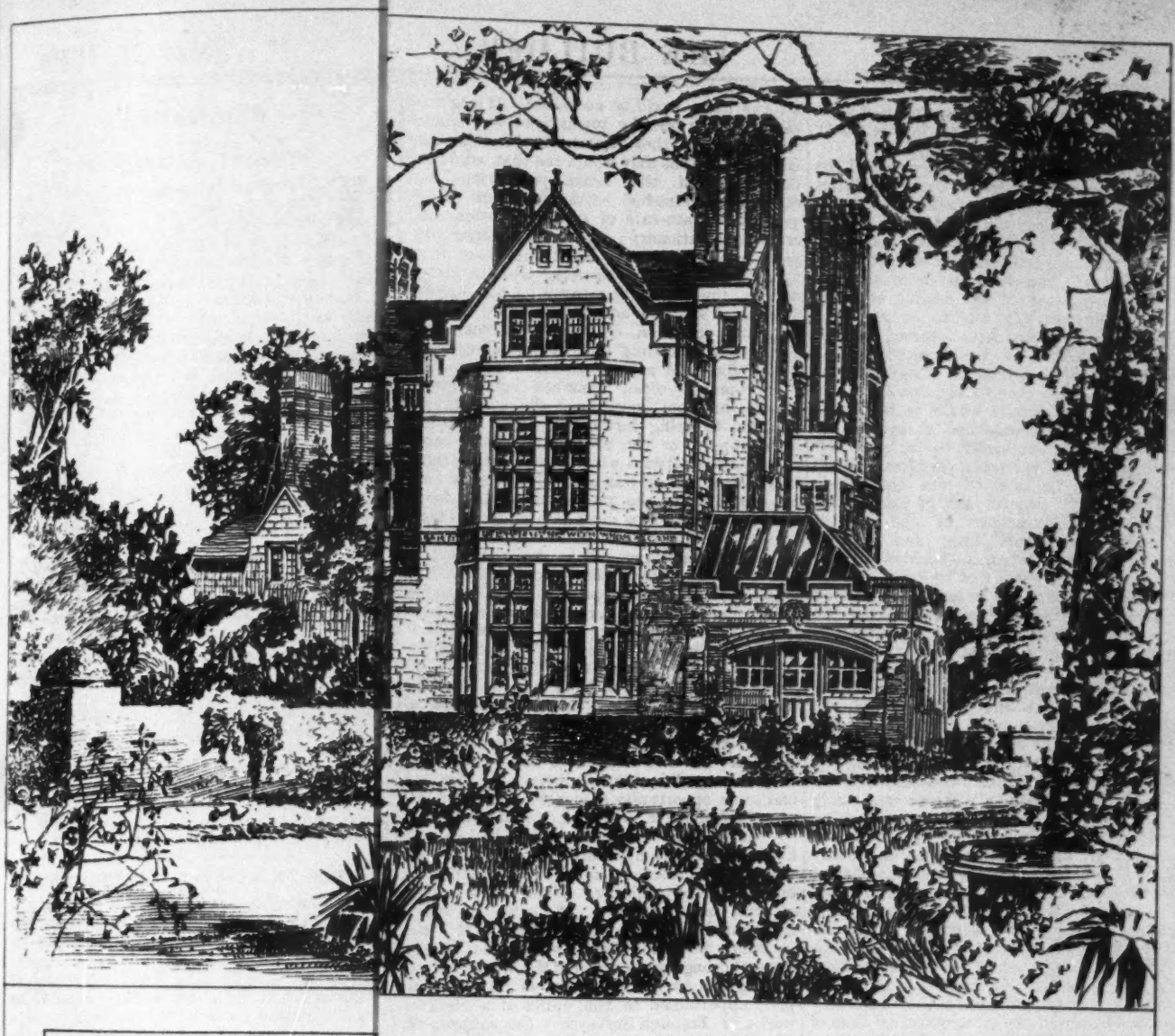
THIS building, now in course of erection, provides for an increase of membership, which has caused the premises now held by the Club to be inadequate for the comfort of those using it. Its position is in the very centre of the town of Leeds, opposite to a site recently acquired by the Postmaster-General for the erection of a new post-office. The materials of which the building will be erected are, for the exterior, red and buff bricks and terra-cotta dressings, covered with green slates. The interior will be finished with some degree of elaboration with hardwood staircases and general joinery, and a considerable extent of ornamental plaster-work. The architects are Messrs. Chorley & Connon; the different builders as follows:—For terra cotta, Mr. J. C. Edwards, of Ruabon; brickwork, Mr. Charles Myers; joiners' work, Messrs. Tomlinson & Sons; plumbing, Mr. J. Lindley; ironwork, Messrs. C. Anty & Co.; slating, Messrs. Sharp & Harper; plastering, Mr. T. Moore; and painting, Messrs. Jackson & Co.; all of Leeds.

The drawing from which the illustration is taken is in the Royal Academy Exhibition.

SCULPTURE AT THE ROYAL ACADEMY AND THE SALON.

THE four sculpture subjects given in this number, from works exhibited at the Royal Academy and at the Paris Salon, are all referred to and described in the first article of the present issue.

Scottish Properties for Sale.—At the Mart, on June 24, (1) Durris, on Deeside, Kincardineshire, extending over 17,000 acres, whereof 8,000 are arable, and yielding a net rental of 9,000*l.* per annum. Durris parish lies on the river's south bank, and slopes upwards to a ridge of the Grampians, where Lord Peterborough laid out some extensive plantations of larch and Scots fir; (2) Dunalastair, with some adjoining estates,—20,000 acres in all,—situated in the Rannoch district of Perthshire, in the Lyon and Tay watershed, between Loch Tummel and Loch Rannoch, famed for its sporting advantages, and the Peak of Schiehallion. On July 22, (3) Ballahulish, on the western coast of Argyll, being 6,000 acres, mostly pasture, with the slate and granite quarries at the foot of Ben Naveay. In Ballahulish is the Levin Loch, whilst but four miles distant lies the Pass of Glencoe: and (4) the whole of the river Thurso, in Caithness-shire, from its rise to the North Sea, well frequented by salmon, and the neighbouring grouse-moors (40,000 acres) of Braal, Dalnawillan, and Strathmore.



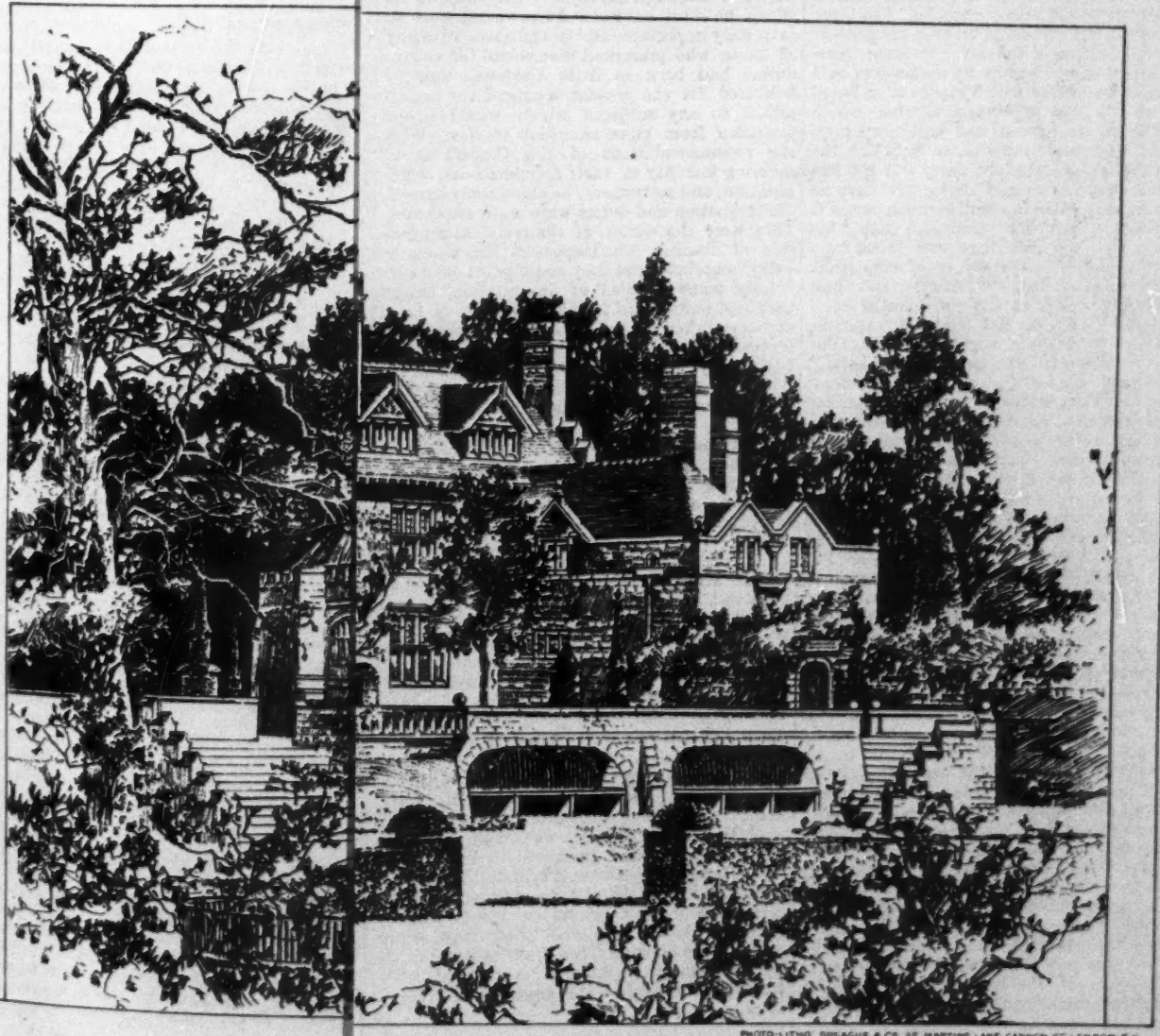


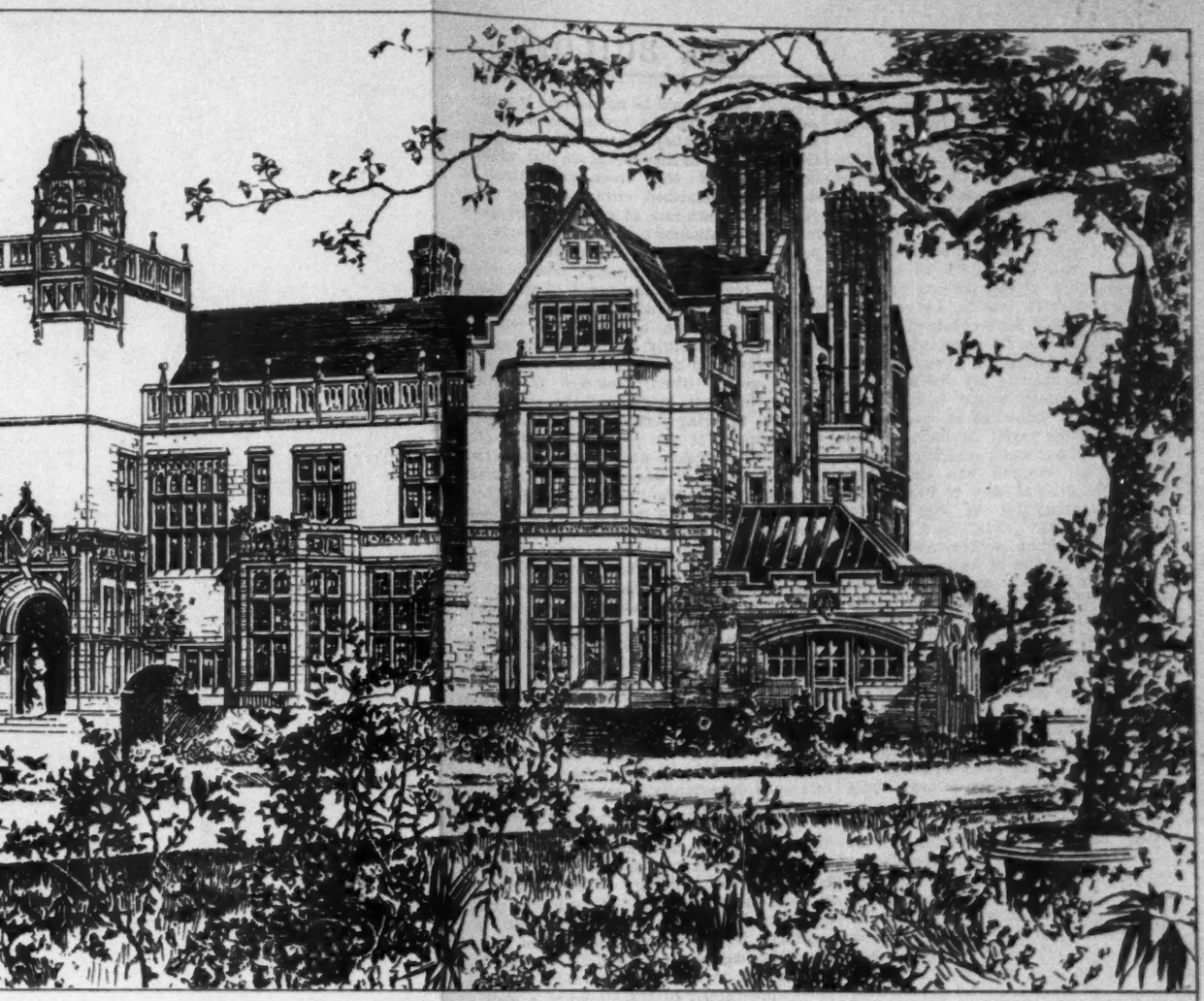
PHOTO-LITHO, SPRAGUE & Co 62, MARTINS LANE CANNON ST LONDON E.C.

RCHITECT.

1816 Royal Academy Exhibition, 1890.

PEVEREY: PROPOSED NEW HOUSE FOR SIR OFFLEY WAKEM

6 Royal Academy Exhibition, 1890.



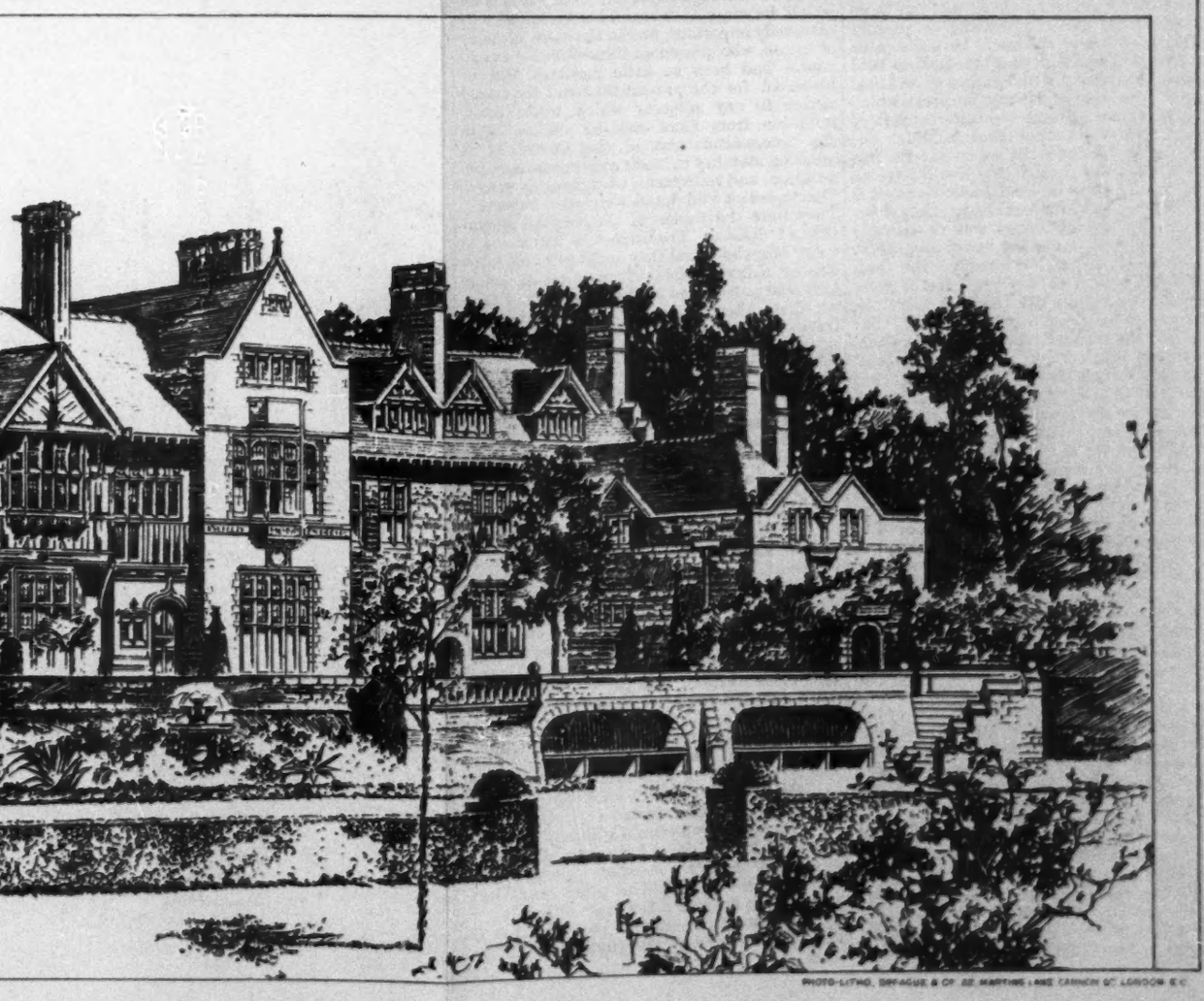


PHOTO-LITHO. SPRAGUE & CO. 62, MARTINS LANE CANNON ST. LONDON E.C.

MAN, BART.—Mr. Aston Webb, F.R.I.B.A., Architect.

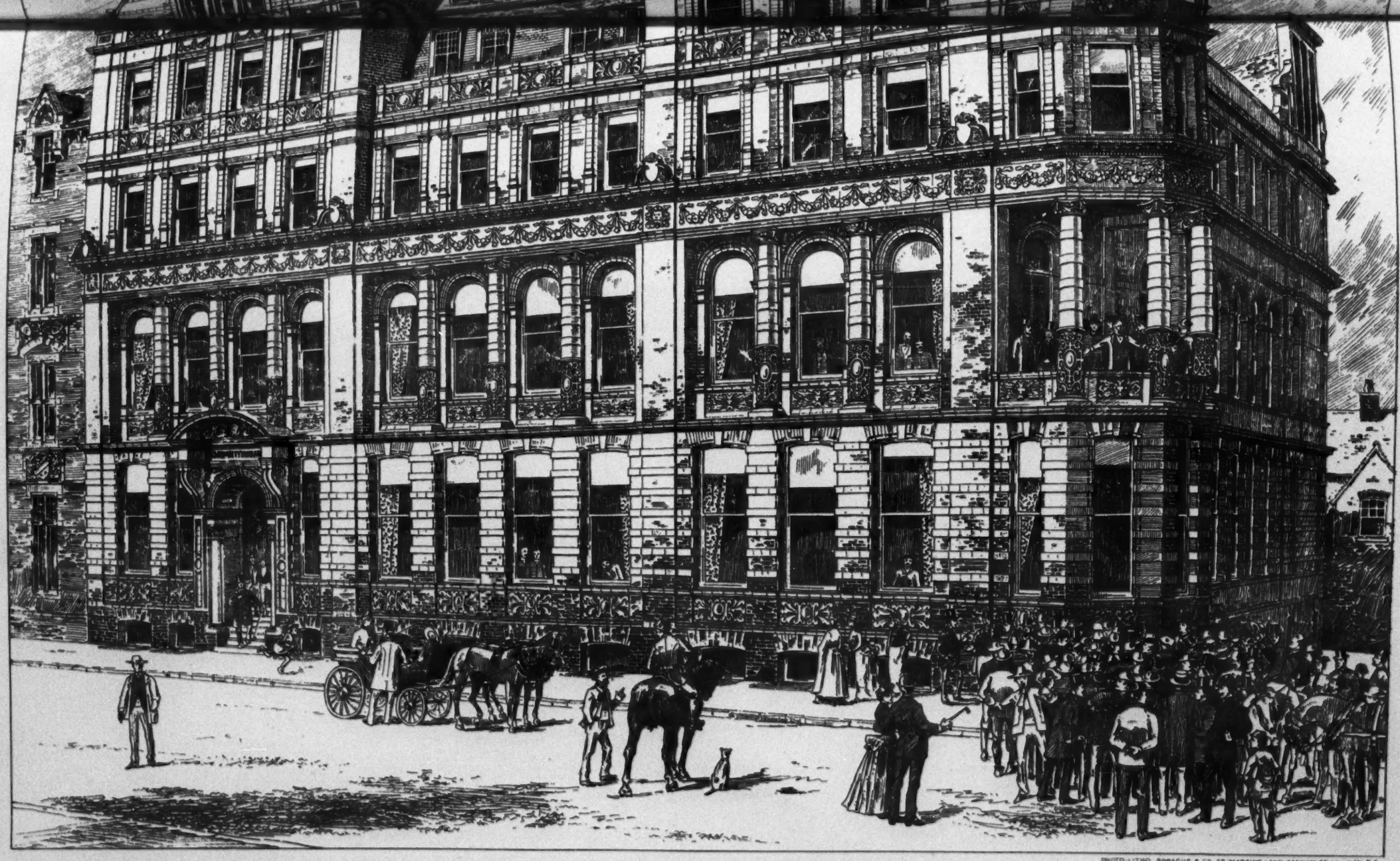
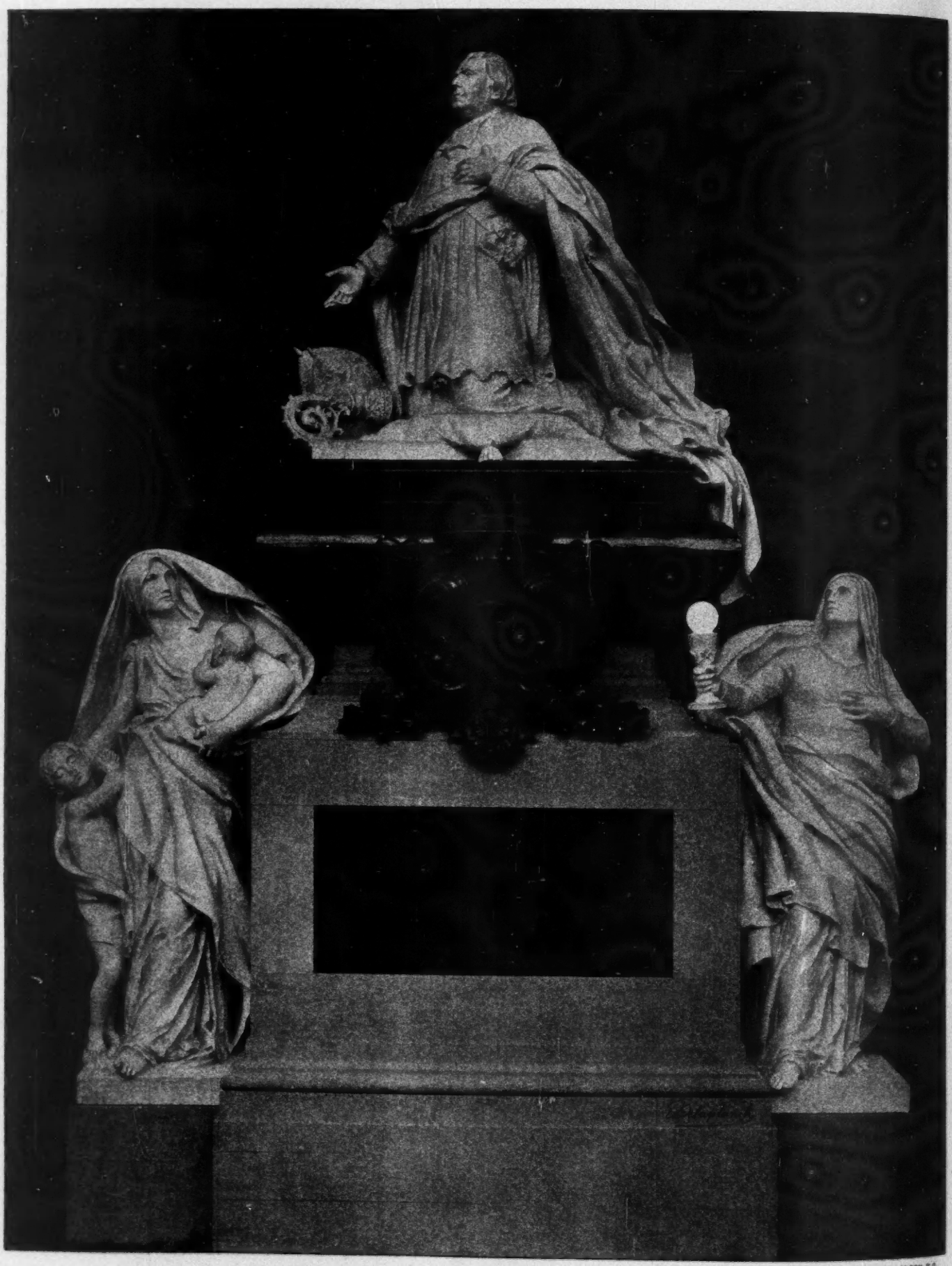


PHOTO-LITHO. SPRAGUE & Co. 22 MARTINS LANE CANNON ST. LONDON, E.C.

THE LEEDS LIBERAL CLUB.—Messrs. Chorley & Connon, Architects.

No. 1890 Royal Academy Exhibition, 1890.



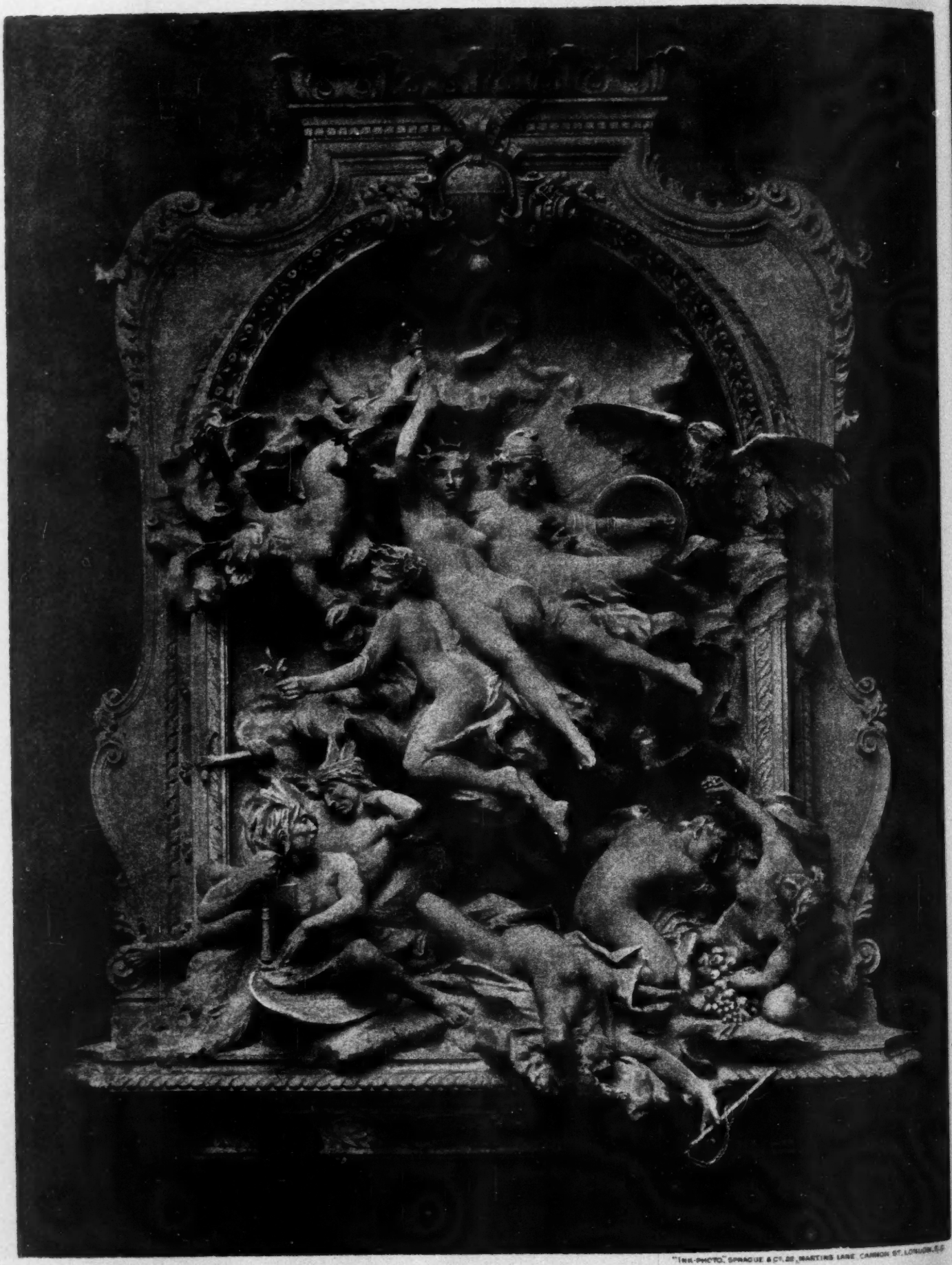
"INK-PHOTO," SPRAGUE & Co., 82, MARTINS LANE, CANNON ST., LONDON, E.C.

MODEL OF MONUMENT TO MONSIGR. DONNET, ARCHBISHOP OF BORDEAUX.

M. DELAPLANCHE, SCULPTOR.

No. 3762, Paris Salon, 1890.

FROM A PHOTOGRAPH BY BLOCK ET CIE., PARIS.



"THE-PHOTO," SPRAGUE & Co., 22, MARTINS LANE, CANNON ST., LONDON, E.C.

DESIGN FOR A RELIEF.—Mr. Charles Lawes, Sculptor.

No. 2004 Royal Academy Exhibition, 1890.

"INK-PHOTO," SPRAGUE & Co., 82, MARTINS LANE, CANNON ST., LONDON, E.C.

THE GUARDIAN ANGEL: RELIEF.—Mr. H. H. Armstead, R.A., Sculptor.

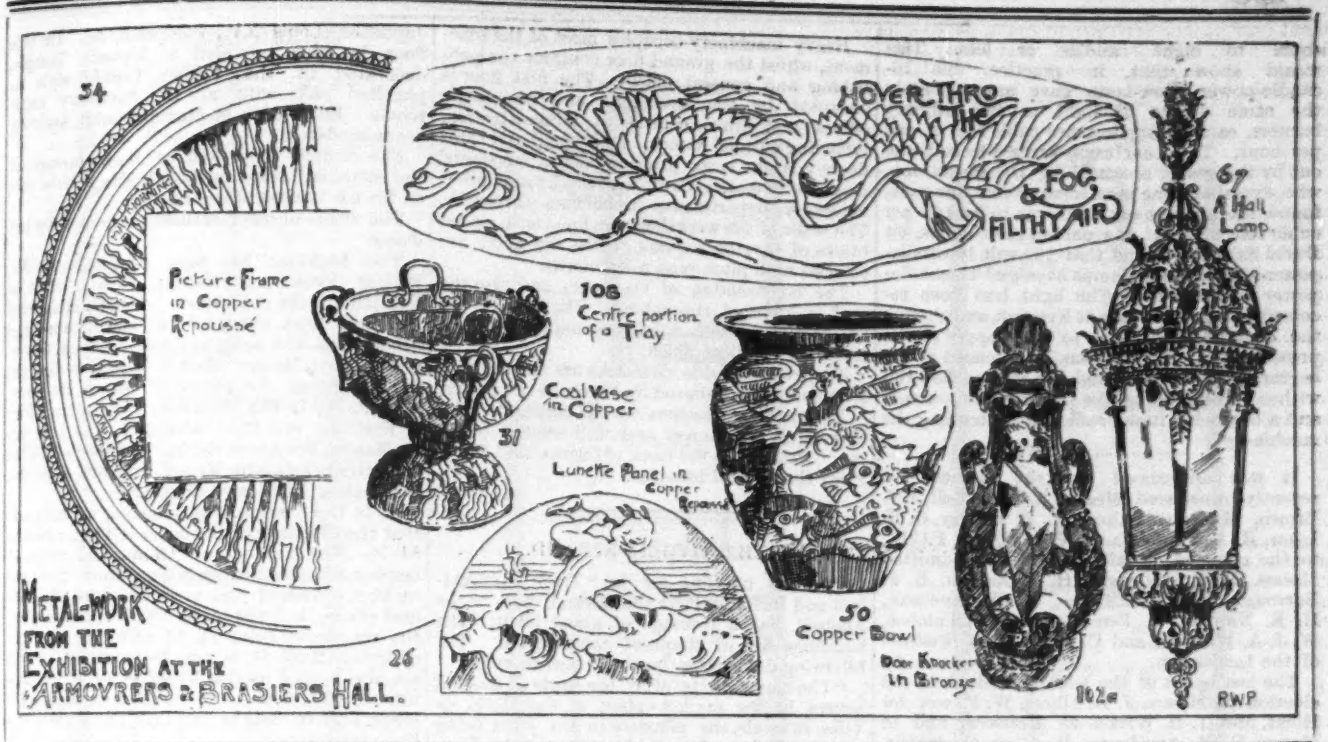
No. 2063 Royal Academy Exhibition, 1890.

"THE PHOTO," SPRAGUE & Co., 82, MARTINS LANE, CANNON ST., LONDON, E.C.

DU GUESCLIN.—M. LEMAIRE, SCULPTOR.

No. 4143, *Paris Salon, 1890.*

FROM A PHOTOGRAPH BY BLOCK ET CIE., PARIS.



THE ARMOURERS' COMPANY EXHIBITION.

By the kind permission of the Armourers' Company we are enabled to give sketches of some of the chief objects in the Exhibition of Metalwork held in the Company's Hall, to which we referred in a "Note" last week.

THE INSTITUTION OF CIVIL ENGINEERS.

At the concluding ordinary meeting of the Session, on Tuesday, the 20th inst., Sir John Coode, K.C.M.G., President, in the Chair, the Paper read was on "The Keswick Water-Power Electric-Light Station," by Messrs. W. P. James Fawcus and Edw. W. Cowan, Assoc.-MM. Inst. C.E.

This was believed to be the first attempt to utilise available water-power in this country for the purposes of a public supply of electric light. Early in last year, the directors of the Keswick Electric-Light Company instructed the authors to prepare plans, and to procure tenders for the erection of a central supply station in or near Keswick. As the area proposed to be lighted was large and sparsely populated, it was seen that the only feasible system to adopt was an overhead high tension one. The alternating-current transformer system was finally selected, and a site on the River Greta, about ¾-mile from Keswick, was chosen for the erection of the station, the river being here available at 20 ft. head. The saving effected in using this water-power was considerable. The rent paid for the water was 10s. per horse-power per annum. Taking the number of horse-power hours required per annum as 100,000 for the present output of the station from a 50-horse-power turbine, the cost per horse-power came out as 0·06d. On the other hand, taking the price of steam-coal at 15s. per ton, and the quantity burnt per horse-power per hour as 6 lb., the cost per horse-power hour came to 0·48d., or eight times the cost of the water-power. In addition to this, the attendance required for a turbine was, of course, less than that necessary for a steam-engine and boiler; the first cost, maintenance and depreciation, were also considerably less, and the chances of a breakdown much less likely. As there was a possibility of partial failure of the water-supply during extreme drought in summer, it was decided to provide steam in addition to water-power. The turbine was of American design, and was called the "Victor." It was of a "mixed-flow" type, the wheel being 20 in. in diameter. Its speed was 273 revolutions per minute; this was at least 70 per cent. greater than the speed of an "inward," an "outward," or a "parallel-flow" turbine would have been, working under a similar head. Its design was exceedingly compact, and the regulation, which was effected by opening and closing a cylindrical sluice working between the guide-passages and the wheel, was all that could be desired. As the turbine was 16 ft. above the level of the tail-race, a draught-tube was necessary to give full effect to the head of 20 ft. This draught-tube was of wrought-iron, 14 ft. long and 3 ft. in diameter. The maximum velocity of water flowing through it was a little over 4 ft. per second. The engine was a Westinghouse of simple type, having two single-acting cylinders, 10 in. in diameter by 9 in. stroke; it gave with 80 lb. of steam, at 350 revolutions per minute, 50·11 brake horse-power. The floor-space taken up by the engine was 7 ft. by 4 ft. The boiler was a 20 nominal horse-power Hyde duplex, 4 ft. 6 in. in diameter, and 11 ft. 6 in. in height. Its working pressure was 120 lb. to the square inch. The alternator, which was designed by Mr. Gisbert Kapp, and manufactured by Messrs. Johnson & Phillips, the contractors for the electrical plant, was a 30-kilowatt separately-excited machine, giving an output of 15 ampères at 2,000 volts. Its speed was 750 revolutions per minute, and the frequency 75. The armature had a cast-iron supporting-ring, 28 in. in diameter and 2½ in. wide, provided with six arms. The armature-core was of charcoal-iron strip, 2½ in. wide, wound with paper insulation to a depth of 8 in. There were nineteen coils, each containing 100 turns of 0·072-in. wire, covered to 0·092 in. in two layers. The resistance of the armature, after working some hours, was found to be 7 ohms. The magnetic field consisted of twelve magnets on each side of the armature. The cores and pole-pieces were of wrought-iron, the yoke-rings of cast-iron. The former were cylindrical, 3¾ in. in diameter. The latter were 4 in. by 7½ in. Each core was wound with six layers of 58 turns per layer, with 0·102 in. wire covered to 0·117 in. The total resistance of the field after working some hours was 11·2 ohms. At full load the energy of the field was 3 per cent. of the output of the machine. The frame-work was of substantial construction, and the machine, when running, was remarkably free from vibration. Its open design admitted of the free passage of air to the armature, which would carry 20 ampères without overheating. The magnets could be racked aside for access to the armature. The exciting dynamo was a 1-kilowatt machine of the gramme type, giving 10 ampères at 100 volts. Regulation was effected by varying by hand the resistance in the field-magnet circuit. Two circuits left the station, both of which were double-pole fused, and provided with double-pole switches and lightning-arresters. There were some special features in the method of carrying out the overhead mains. If wire of high insulation had been used, the expenditure would have been considerable, and it did not appear that any great advantage, other than increased durability of the mains, would have resulted. It was, therefore, determined to use a lower insulation for the mains, and to rely upon the points of support for insulation, also to use special arrangements for cutting off all surface leakage where the wires entered the consumer's premises. The authors were not aware that attention had been paid to this point before, yet it would seem that in wet weather, upon a long line of overhead mains, even with the best insulation, the surface leakage, when high-tension currents were employed, would be considerable; and if devices were not adopted for cutting this off, where the wires entered buildings, leakage to earth must result, which might be a source of danger as well as of loss. The mains at Keswick were being insulated from earth, and from each other, by oil throughout the system. The house leading-in wires were insulated with vulcanised india-rubber of the highest quality, and were threaded through a shackle oil-insulator, the wire being cemented in with Chatterton's compound. Such an arrangement should effectually cut off surface-leakage from the mains. The leading-in wires entered the roof through a stone-ware pipe, provided with a covering-piece to keep out rain and cover a reservoir of oil in the mouth of the pipe. The sizes of the mains were fixed for a current density of 500 ampères to the square inch. The fall of potential, between the generating-station and the town, was only slightly above 1 per cent. at full load. Steel suspension-strand was used for supporting the mains for all circuits, consisting of three strands, each strand being 14 B.W.G., and galvanized. One short run of underground mains was being tried, the Brooks fluid-system being used. This system had much to recommend it; it was simple, cheap, and durable, and did not take long to lay down. The transformers were Kapp's patent, and they transformed the high-tension current of 2,000 volts to 100 volts. A double-pole, quick-make and quick-break switch, with double-pole fuse and lightning-arrester, was used in the high-tension circuit with each transformer. Both the transformers and the switches were enclosed in cast-iron water-tight cases. A series of experiments had been made to test the efficiency of the machinery, with the result that the total efficiency of the generating-plant at the station came out at about 40 per cent. at ¼ full load, and over 70 per cent. at full load. In connection with the arrangement of this central-station scheme, the authors had occasion to make a comparison between the illuminating power of the glow-lamp and gas; the results showed that the relative values usually given were misleading, and they almost invariably dealt with a standard London Argand, a burner seldom used for ordinary lighting. This burner was generally taken as giving from 15 to 16 candle-power for five cubic feet of gas consumed per hour; whereas out of a large number of ordinary burners taken haphazard, and tested where they were in use, in Chester, Manchester, and Keswick, at various times, it was found that the light given by five cubic feet of gas per hour was more frequently

equal to eight candles or less. This would show that, in practice, one 16-candle-power glow-lamp gave approximately the same degree of light as two ordinary burners, each consuming five cubic feet of gas per hour. This conclusion seemed to be borne out by the result obtained by Dr. Hopkinson, who, experimenting upon some ordinary burners, found the average candle-power to be 1·76 per cubic foot of gas. As regarded glow-lamps, Sir David Salomons found that 100-volt 16-candle-power Edison-Swan lamps averaged 17-candle-power at 100 volts. The light had been received with great favour at Keswick, and already the demand was equal to the supply of the present plant. Supply was commenced at the beginning of the year, and the station had run without hitch up to the present time—a man and a boy being found sufficient for tending the machinery.

It was announced that the Council had recently transferred Messrs. A. W. D. Bell, J. S. Brown, M. Grant-Dalton, H. B. Harvey, G. R. Lynn, H. A. Purdon, and W. J. Wilson, F.C.H., to the class of *Members;* and had admitted Messrs. N. P. Anderson, H. T. Ashton, E. S. Burrough, P. V. McMahon, R. W. Newman, H. E. Newton, J. Perez-Seoane y Villalobos, W. J. A. Watkins, and C. E. Wolff as *Students* of the Institution.

The last ballot of the session resulted in the election of Messrs. J. B. Alliott, W. P. von der Hörst, and T. H. Wickes as *Members;* and of Messrs. G. E. Abrahams, P. Allan, O. Archer, W. Banks, Stud. Inst. C.E., W. F. Barry, B. R. Beale, B.A., Stud. Inst. C.E., G. W. Budd, H. A. Caffin, Stud. Inst. C.E., G. B. Dunn, M. Elliot, H. T. Foord, Stud. Inst. C.E., H. Hinds, A.K.C., Stud. Inst. C.E., G. H. Holden, A. H. Kingsley, B.A., T. E. Laing, C. Law-Green, J. Lee, M.A., T. S. McCallum, H. W. Prince, Stud. Inst. C.E., H. W. Ravenshaw, A. Stewart, V. de Timonoff, and W. H. Todd as *Associate-Members*.

The annual general meeting, to receive the report of the Council, session 1889-90, and to elect the Council for the ensuing year, will be held on Tuesday, June 3, at 8 p.m.

THE EMPLOYERS' LIABILITY BILL.

THE Joint Parliamentary Committee of the Institute of Builders, the Central Association of Master Builders of London, and the National Association of Master Builders of Great Britain, requested the Home Secretary to receive a deputation from the Joint Committee to lay before him the objections which the building trade, as large employers of labour, and specially affected by the proposed amendment of the law, entertain to the provisions of the Employers' Liability Bill. The Home Secretary has caused the following letter to be sent to the Secretary of the Institute of Builders:—

"Home Department, May 23, 1890.

Dear Sir,—I have laid your letter of the 23rd inst. before Mr. Matthews, and he desires me to say that though he would have been glad to have conferred with the members of your Institute, yet he feels that under all the circumstances, and in consideration of the fact that the views of your Institute were fully laid before him last session, and are now present to his mind, no useful object would be served by his receiving another deputation on this subject at the present time.—Yours faithfully,

(Signed) E. RUGGLES-BRISE.

R. S. Henshaw, Esq."

THE ARCHITECTURAL ASSOCIATION VISITS:

NEW PRINTING-OFFICES IN BREAM'S-BUILDINGS.

THE last of the visits for this session took place on Saturday afternoon, when a party of members of the Association, under the guidance of the architects, Messrs. Satchell & Edwards, paid a visit to the new printing and publishing offices in Bream's-buildings, Chancery-lane, of the *Field*, the *Queen*, and the *Law Times*, which are now almost ready for occupation, and will supersede the well-known building in the Strand.

No expense has been spared to make the new building constructionally sound, and if the result externally is not an æsthetic success, the blame need not be wholly attributed to the architects. The site is a rectangular one, and has been almost covered with buildings, every part of which is thoroughly well lighted, and in this respect cannot be too highly commended.

Heavy machinery occupies most of the basement, whilst the ground-floor contains the publishing and general offices. The first floor is occupied by the manager's and secretary's offices and other centres of administration, including editors' rooms. The second and third floors contain large printing and compositors' rooms, with manager's offices, foundry, and other necessary departments in contact therewith. The walls of the workshops are lined with glazed bricks of varying colours, whilst the floors are covered with pitch-pine wood blocks.

The construction of the floors and also the roof is fireproof throughout. The latter is flat and is covered with Claridge's asphalte, which forms an excellent finish.

The front and side elevations are treated with Portland stone, relieved by Fareham red bricks.

Messrs. Dove Brothers are the contractors for this carefully-planned and well-erected building. Mr. Fisk is the clerk of works and Mr. T. Pratt the general foreman.

"THE TIVOLI," STRAND.

THE new building for the "Tivoli" Concert-hall and Restaurant, in the Strand, close to the Adelphi, has a frontage of about 90 ft. The buildings are of fireproof construction. The following description has been sent to us:—

"The elevation is after the style of the old houses in the market-place of the Hôtel de Ville, Brussels, the pilasters in the front being composed of marble and bronze, and the front itself of Corsham stone.*

The entrances to the concert-hall are on three sides of the building. The area is entered by a broad staircase, and is provided with three exits. The balcony is entered from the grand entrance-hall, and has two exits.

The first balcony is approached by a wide staircase, and also has two exits, the exit accommodation being equal to over 5,000 persons, whereas the actual seating accommodation is calculated at about 1,000, and the promenade, lounges, &c., about the same. On each tier ample space has been set apart for promenade purposes. The staircases throughout are composed of concrete, which is imperishable. On each level retiring-rooms for both sexes have been provided. The interior decoration is Indian in style.

Sprinklers on the non-automatic system have been placed over the stage, and are controlled by valves fixed near the artistes' door, where is also placed a hydrant, the whole being under the control of the fireman. The whole building is provided with hydrants. The artistes' rooms are well ventilated, and are fitted with every accommodation, the lady artistes being on one side of the stage, and the gentlemen on the other. There are two exits from the stage.

The restaurant consists of a buffet on the Strand level, the 'Palm Room' on the first-floor, the 'Flemish Room' on the second-floor, and the private dining-rooms on the floor above, with the kitchens and offices on the top floor. The restaurant is entered from the corner of the Strand and Durham-street by a grand staircase, and a lift enables diners to reach every floor without trouble. The floor of the 'Palm Room' will consist of tiles of marble. The dado, which is panelled, is also of alabaster and marble. The room was to be divided into sections (so as to partially screen each table) by carved figures representing Cupids driving swans, supporting real palms intermingled with leaves of bronze palms, the latter rising to the ceiling supports, and dividing the wall surface above the dado into panels which are filled with Venetian mirrors to correspond with the windows, but this design has been somewhat modified, the Cupids and swans being omitted. The ceiling is divided by groups of palm-leaves, forming pendants, from which hang globes representing the fruit of the palm, the ceiling being lighted from these points. The colouring will be enamel, ivory-white, and gold. The room is about 60 ft. long by 25 ft. wide.

On the second floor, the 'Flemish Room,' another large dining-room of the same size, is decorated in the old Flemish style with carved oak. The walls and ceilings are panelled in oak, with tapestry panels to walls and polished oak floor.

On the third floor are the private dining-rooms, decorated in different styles: Moorish, Japanese, Louis XV., Pompeian, &c. On this floor is also provided a Masonic Temple, decorated in the French Gothic style in panelled oak, with all the necessary ante-rooms. Each floor is provided with lavatory accommodation.

The electric light will be used throughout the entire buildings, although gas will be laid on for use in case of emergency.

The whole of the restaurant is heated by hot water.

The building has been designed by Mr. Walter Emden, architect; Messrs. Kirk & Randall are the contractors; Messrs. Heighway & Depree have executed the marble work and decorations, the sculptors being Messrs. Goyer, of Louvain; Messrs. Shand, Mason, & Co., the fire appliances, for which Mr. George Harrison, A.M.I.C.E., is the engineer; Messrs. Hackford & Farthing are the surveyors. The lifts are by Messrs. Waygood, the gas and special Indian gas fittings being by Messrs. Vaughan & Brown, the heating by Messrs. Cowan."

As to the heating arrangements, we may add that the diameter of the boiler is 40 in.; height 64 in. The number of "flows and returns" employed in this theatre is ten of each. The total number of feet of pipe used, exclusive of bends and elbows, is 3,440 ft., of which 1,150 are 2 in., the remainder being 1¼, 1½, and 1 in. Of this quantity, 2,260 ft. is run horizontally. There are also heated by this boiler 41 radiators, containing 608 loops, each radiator averaging 14½ loops, and in height 36½ in. The system is a low-pressure one.

* Whatever merit the *façade* might have possessed as an architectural composition is marred by the gigantic letters TIVOLI which have been fixed on the top story.—ED.

A PLEA FOR IMPROVEMENT OF SIX- AND EIGHT-ROOMED HOUSES.

SIR,—In these days of improved dwellings for the poor and superior planning of the houses of the rich, it seems inconsistent that the houses rented by persons of smaller means should be comparatively neglected. Houses of six and eight rooms are built on one stereotyped plan, and the sooner this is attacked and improved, the better.

As we judge of all things by contrast and comparison, I propose to do so in this case by examining the defects of the everlasting plan (fig. 1) upon which these small houses are erected. The door on one side, staircase beyond in centre of block, lighted by two square feet of glass over front door, and about 12 ft. distant; the room behind lighted by a hybrid French window squeezed into one corner, and looking down an alley overshadowed by back addition, making this (the usual sitting-room) so cheerless and sunless as to force upon us the remembrance of that dreary passage in Scott's "Rokeby,"—

"Although the sun was on the hill,
In that deep dell 'twas twilight still."

Then up the dark staircase we come to a drawing-room on first floor, a back-room in rear, and on second-floor two bedrooms and a sort of dressing-room. The back addition sometimes has a passage-way out to side alley, sometimes not; then come kitchen, with door opening opposite front door, that every one who calls may see what is going on; beyond, a scullery, and outside this a w.c. and dustbin, so that where there is a garden the scullery and water-closet have the privilege of it; the children being relegated to a sunless room, although air and sunshine are of vital importance to juvenile life. Above this block are frequently two rooms, one beyond the other, and one a passage-way to the other, that is to say, the privacy of each is destroyed; sometimes a bath and w.c. are provided on this floor. To this antiquated arrangement I propose an alternative, adding little to the cubic contents, but improving the distribution of the rooms; *vide* sketches (fig. 2, 3, 4, and 5). By any of these arrangements the two best rooms in the house have the best outlook,—one over the road in front, the other over the garden (the usual position selected for a drawing-room). Neither of these rooms need be dominated or overshadowed by other parts of the building, whilst the working rooms (kitchen and scullery) have a central position, with side-alley set apart as a kitchen court, the staircase being lighted and ventilated by a tall window, which may also light the passage. If the tenants can afford it, the front room on first floor could be set apart for a drawing-room, and the room on ground-floor overlooking the garden might be used as an ordinary living-room, being bright and sunny and available for children, enabling the other

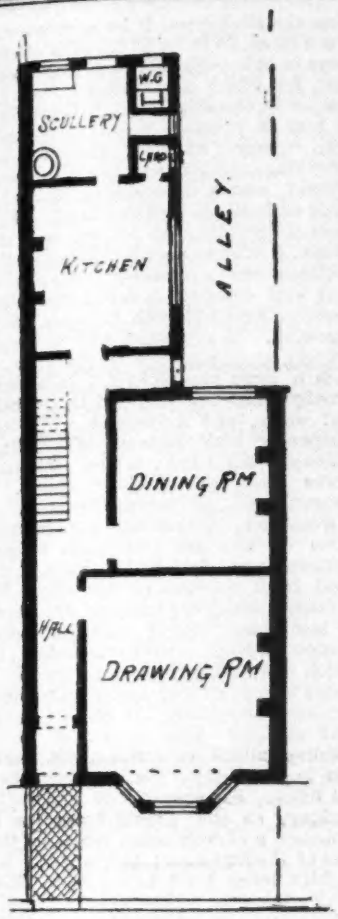


Fig. 1.
"The Everlasting" Plan.

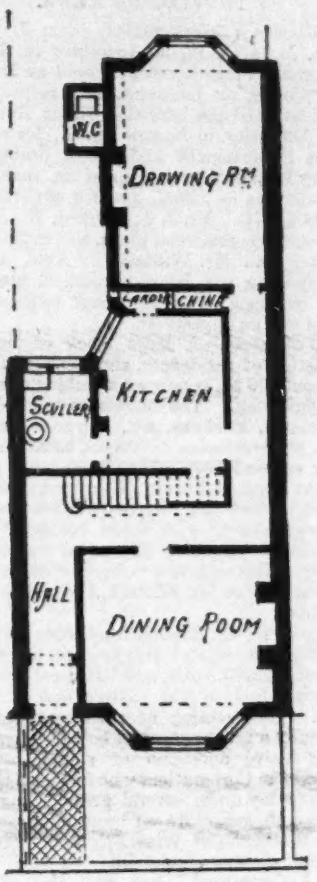


Fig. 2.—Ground Floor.
Stairs lighted over Scullery.

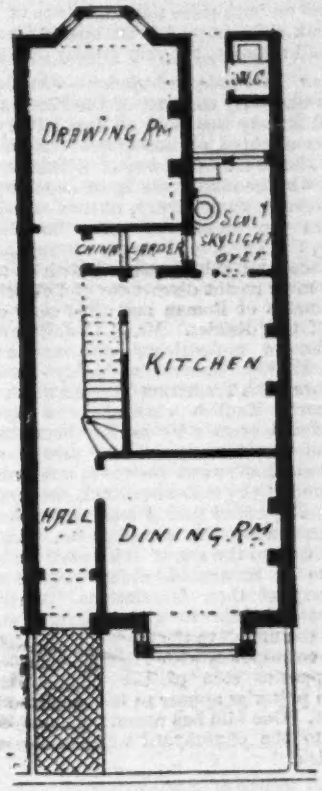


Fig. 3.—Ground Floor.
Stairs lighted over China Closet.

parts of the house to be kept neat and tidy. On the first floor there can be four bedrooms, a bath-room, w.c., and rooms in roof. Again, if the tenant should sublet a moiety, the arrangement would be found most convenient, one family occupying the front portion, the other the back.

I appear not to be alone in this my advocacy for improved planning, as houses have been built something on this plan in several parts of London, and in neighbourhoods that are ripe for building they are taken with avidity. I have treated of houses of two and three stories only, without basements, as basements for such property are not popular.

Reference to the several plans will demonstrate the convenience recommended.

T. E. KNIGHTLEY.

106, *Cannon-street, E.C.*, May 19, 1890.

ARCHÆOLOGICAL SOCIETIES.

British Archæological Association.—At the meeting of this Association held on May 21, Mr. J. W. Grover, F.S.A., in the chair, a series of flint implements found during the progress of sewerage works at Forest-gate and Wanstead, Essex, were exhibited by the chairman, among the objects being a singular flint knife, very smooth and thin. Two bronze celts were also exhibited, which were recently found near Mitcham Junction, 6 ft. deep in drift gravel. Mr. Macmichael described several articles of Roman fictile ware which have been found in some excavation works in Bow-lane, among them being an almost perfect mortarium and a fragment of a very large vase of Upchurch ware. A paper was then read by Mr. W. J. Davis on an altar-slab which exists at Sheepscombe, Gloucestershire. After referring to many curious evidences afforded by ancient place-names in the locality he indicated their bearing upon the recorded history. Many of the old names are similar to those found in Scandinavia, and there are many indications of the presence of the Danes, Deadcombe being the site of a battle in which the invaders were routed. The Earls of Shrewsbury had an extensive mansion in the parish, and the altar-slab which formed the subject of the paper belonged to the private chapel of the mansion. This has long since been demolished, the ruins being used as a quarry. The slab is now built up over the door of a pig-sty. It bears an inscription recording that it was consecrated by Nicholas, who was Suffragan Bishop of Worcester, 1392–1421, and dedicated to the Holy Trinity and All Saints. In the discussion which ensued, Mr. E. Walford referred to the very few examples which remain of inscribed altar-slabs. The second paper was by Mr. E. P. Loftus Brock, F.S.A., who described some curious features of Saxon architecture at Sterrington Church, Beds. The western tower has been found to be of Saxon work. This was revealed during the restoration of the church in 1872. Still more recently,

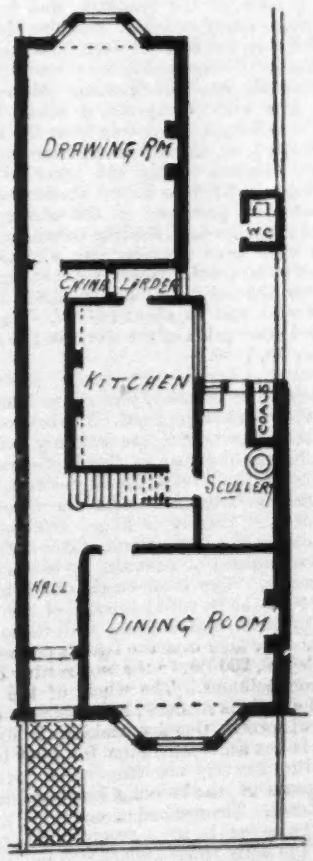


Fig. 4.—Ground Floor.
Stairs lighted over Scullery.

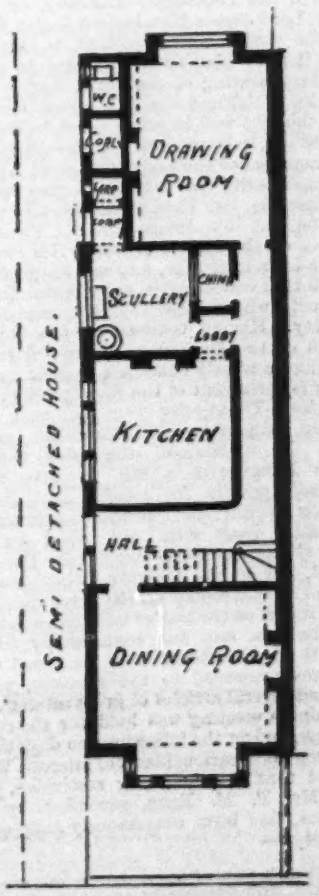


Fig. 5.—Ground Floor

the Rev. J. R. H. Duke, Vicar, observing some indications of openings in the north and south walls (now within the later aisles), had the plaster removed, with the result that a south doorway has been found, and two windows splayed on both sides alike. In one of them a thin oak slab, in which an opening had been cut, still remains, but very greatly decayed.

Essex Archæological Society.—On the 22nd inst. a quarterly meeting of the Essex Archæological Society was held at East Tilbury. The visitors alighted at Low-street station (which is the site of the discovery of a Roman burial-place, whence many urns have been obtained), and drove to East Tilbury, where a meeting was held in the schoolroom. The Rev. H. J. E. Barter, the Vicar, read an interesting paper on the place and neighbourhood, with an account of the more recent discoveries and evidences of the remains of Roman and other early occupation of the district. Mr. F. C. J. Spurrell, the well-known archæologist, also read a paper. East Tilbury Church, a highly-interesting structure, with Transition-Norman north arcade and early English chancel, was described. It suffered greatly by having been battered by the Dutch fleet which passed up the Thames in 1667, when the tower was destroyed, and, probably by the same attack, the south aisle of the Decorated period was demolished. In anticipation of the meeting, the Vicar had kindly caused the site of the tower and south aisle to be excavated, which had led to the discovery of their foundations. A visit was afterwards made to the Roman Causeway across the marsh to the margin of the Thames, which corresponds with Higham Causeway on the opposite side of the river. Extensive Roman potteries appear to have existed in this district. One kiln has recently been discovered close to the churchyard wall.—*Essex County Chronicle.*

Royal Society of Antiquaries of Ireland.—A largely-attended meeting of this Society (until lately known as the Royal Historical and Archæological Association of Ireland) was held in the Town-hall, Kilkenny, on the 20th inst., Lord James Wandesford Butler, President, in the chair. The President, in his address, said it gave him much pleasure to preside at the first meeting of the Royal Society of Antiquaries of Ireland,—a title which her Majesty had thought well to grant them, he believed, he might say, in consequence of the exertions made by members of the body formed in Kilkenny as far back as the year 1849 by his (the President's) brother, the late Lord Ormonde, who was aided by the late Rev. James Graves. Though not a native of the city of Kilkenny, he had resided there for a long time, and was deeply interested in all that concerned it, more particularly in the subjects which more especially concerned that society. Having touched on the objects and scope of the Society, he expressed himself as feeling peculiarly honoured by being chosen as the first president of the Royal Society of Antiquaries.—Twenty-five new members were declared elected.—Mr. Cochrane mentioned that he understood the Irish Government were bringing in a Bill to give them increased powers for repairs, and Kilmallock Abbey would be specially mentioned and specially dealt with. He hoped that before long the Government would take the Abbey in hand, but in the meantime they proposed to spend a little money on the place themselves.—The report on the matter laid before the meeting by the hon. sec. was unanimously adopted.—Mr. D. H. Creighton, hon. sec., read a list of objects presented to the museum, which included several articles of great interest.—In the evening a meeting was held for the reading of papers, and on the following two days there were excursions to various places of interest. We understand that the following resolution, proposed by Mr. P. M. Egan, seconded by Colonel Vigors, has been unanimously adopted by the Society:—

"That, in view of the announcement recently made that the Irish Government are at present engaged in drafting a Bill to amend the National Monuments Act and the Ancient Monuments Protection Act, 1882, the Council of this Society be requested to place themselves in communication with the authorities, and to point out the necessity that exists to make the proposed Act sufficiently comprehensive to enable the Government to take into its custody any church, monument, tower, or other building of a like character, and of archæological interest, such as are scheduled in either of the above Acts, provided satisfactory title cannot be obtained. We trust the legislation on the subject will empower the Treasury to contribute an amount equal to the local aid for maintaining any monument which the Board of Works may approve of."

PROVINCIAL NEWS.

Billesdon (Leicestershire).—Mr. J. T. Harrison, M. Inst. C.E., an Inspector of the Local Government Board, recently held an inquiry at the "Castle," in Leicester, with respect to the application of the Billesdon Union Rural Sanitary Authority to borrow 6,203*l.*, for works of street improvement and storm drains. The money intended to be spent in making the storm drains is 1,266*l.*, and for street improvements 4,937*l.* Mr. J. B. Everard, M. Inst. C.E., of Leicester, produced plans, and explained the former, and Mr. William F. Ault, Assistant Surveyor to the Board, produced plans, and gave evidence as to the street improvements. There was no opposition.

Birmingham.—A large block of buildings, consisting of residences, and having a frontage of about 500 ft., is now approaching completion at Edgbaston. The houses have good reception-rooms, kitchens, &c., entrance and back halls, and vestibules, bedrooms, bath-rooms, and other conveniences. They have large gardens both at front and back. The front elevation is Gothic in character, with bay windows, two-light windows above, with stone columns, arches, labels, and tympana. The total cost is about 10,000*l.* The architect is Mr. J. Statham Davis, and the builder Mr. Edward Airey, both of Birmingham.

Brighton.—An important addition to the sea-side improvements at Brighton, in the shape of a terrace, shelter-hall, and lift, were opened on Saturday last at the eastern end of the sea front. The erection of extra groynes, more especially a great groyne of concrete, has led to an extensive accretion of shingle, and has enabled the Corporation, who now own the foreshore, to lay down several grass lawns similar to, though not quite so large as those which flank the beach at West Brighton. The development of this undercliff roadway, known as "Madeira-road," has had the effect of making this part of the sea-front increasingly popular, so much so that the Corporation at last found themselves impelled to give effect to the suggestions that had been repeatedly offered to provide a shelter to a large portion of the roadway, and to afford some more ready means of reaching the top of the cliff than has hitherto been furnished by the long flights of steps which have done duty since the sea-wall was constructed, half-a-century ago. The work comprises a raised terrace, 1,304 ft. in length, projecting from the sea-wall and carried on massive iron girders supported by iron columns. This will serve as a promenade, and will also afford shelter for many thousands of persons. In the centre of the terrace a shelter-hall, reading-rooms, and lavatories have been provided, as well as a lift worked by hydraulic power, large enough to be used for the raising of handchairs. The cost of the work will be about 14,000*l.* We gave a detailed description of the work in the *Builder* for May 18, 1889.

Bromley (Kent).—New baths, public hall, and theatre at Bromley, Kent, have lately been opened, so far as completed. The entire scheme is described as unique, the building being cut into a hill in the rear of the High-street, and 35 ft. below the level of the High-street, so that although the baths are under the theatre, the floor of the theatre is about level with the pavement in the High-street. The building is executed entirely of concrete up to the floor of the theatre. The total height of the building is 110 ft. by 55 ft. wide; the size of the bath is 80 ft. by 35 ft., and is lined with white glazed bricks. The floor over the bath is of compound iron girders, 250 lbs. to the foot, resting on 9-in. cast-iron columns. The whole of the ceiling over the bath is rendered in Robinson's cement upon wirework, thereby making it fireproof. There is box accommodation for forty bathers, while the lavatory accommodation here, as in other parts of the building, has been carefully considered. The method of emptying the bath into the sewer is by a receiver, 30 ft. deep, below the bath, from whence it is pumped into the sewer. Machinery has been fitted for heating the bath to 70 or 75 degrees, pumping all the water-supply from a well which has been sunk upon the site to a depth of 300 ft., emptying the receiver into the sewer, in addition to heating the hall. This part of the work has been carried out by Messrs. Russell, of Oxford-street, W. The spacious hall and theatre, 80 ft. by 35 ft., is brick-built, lofty, and has a domed ceiling; the lighting and ventilation being by Messrs. Vaughan & Brown. The main entrance from the High-street is by a wide corridor and crush room, 35 ft. by 22 ft., with efficient doorways to hall, with additional exit doors on each side, for which a verandah of iron has been erected at one side leading to the road and fields in rear of premises, all the doors being fitted with "panic" fittings. There is a large and lofty stage, with arrangements for working the scenery, and a fire-resisting curtain; while a large orchestra is provided at the other end to meet the requirements for orchestral entertainments, serving as a gallery during the theatrical performances; underneath this is a green-room, with exit doors at each end, the entire being rendered fireproof with Robinson's plaster on wirework. In connexion with the stage there is every accommodation for the artists, together with a large property-room under the stage. Fire-hydrants are provided in the hall, bath, and stage, and connected with the water company's high-pressure main. Mr. W. A. Williams, A.R.I.B.A., is the architect. The works were executed by Messrs. Thomas Gregory & Co., of Clapham Junction.

Gloucester.—On the 23rd inst. the foundation stone of the new municipal buildings for Gloucester was laid by the Duke of Beaufort, Lord High Steward of the City. The new buildings, which are expected to cost from first to last about 30,000*l.*, were designed by Mr. George H. Hunt, architect, London. The site, which was formerly occupied by Sir Thomas Rich's School, offered special difficulties to the architect, and though it was originally hoped that at least some portion of the existing building might be utilised, Mr. Hunt found this impracticable. In his design he placed the offices, for easy access and facilities of working, on the ground-floor; the Council Chamber and committee-rooms on the front part of the first-floor; and a public hall at a slightly lower level to the rear. The Town Clerk's, Surveyor's, Accountant's, rate-collectors', School Board, and other offices, are commodious, and Mayor's parlour, retiring-rooms, kitchen, and other departments are provided. The Council Chamber is 45 ft. by 31 ft., exclusive of a public gallery; and the public hall is 78 ft. by 40 ft., with a platform and gallery. The main front of the building is designed in a phase of the Renaissance style, and will be executed in stone; the floors in the entrances, halls, and gallery, in vitreous mosaic; the remainder of the galleries paved. The internal fittings will be of wainscot oak and red deal. We gave a detail elevation of the principal front, a perspective view, and two plans of the building, in the *Builder* for July 13, 1889.

Ipswich.—We are informed that a theatre is about to be erected by a new company in Ipswich, under the patronage of the leading men of the district. In the old theatre of this town David Garrick made his first appearance, and Mrs. Keeley, then Miss Goward, a native of Ipswich, began her dramatic career, whilst in later years Mr. J. L. Toole made his début on its boards. Ipswich has greatly increased in latter years and has now some 60,000 inhabitants. The new theatre will be constructed to hold about a thousand people. The site is in the middle of the town, in Carr-street, which, under the town improvements, has been widened; it should prove an admirable site. The theatre will be fireproof, and will be lighted by electricity; it will also be isolated from other buildings. Mr. Walter Emden has been appointed architect, and Mr. Arthur Pearce, F.C.A., is secretary.

Manchester.—The new "Palace of Varieties," Oxford-road, Manchester, will soon have the Salvation Army for a very close neighbour. The opposite corner site to the above, facing Oxford-road, with 90 ft. frontage and the new 60 ft. thoroughfare called Whitworth-street, with 120 ft. frontage, has been secured by General Booth for close upon 15,000*l.* Preliminary sketches of the buildings proposed to be put upon the site,—viz., a large "citadel" accommodating 3,000 persons, temperance hotel, and several shops and offices, are being prepared by Mr. J. Williams Dunford, architect, of 101, Queen Victoria-street, E.C.. The cost of the buildings will be about 12,000*l.*

Newcastle-on-Tyne.—The first contract in connexion with the erection of "Citadel" buildings in Westgate-road, Newcastle-on-Tyne, for the Salvation Army, has lately been let to Messrs. Middlemiss, Bros., of the same town, for 3,125*l.* The block comprises a large hall seating 3,000 persons, Divisional Headquarters, shop, and other usual appurtenances. The total outlay will be about 8,500*l.* Mr. J. Williams

Dunford, of Queen Victoria-street, London, is the architect.

Oxford.—The *Academy* states that Mr. S. B. Worthington, a member of the committee, is instructed to prepare plans for the new buildings of Manchester New College. The works are estimated to cost 49,000*l.*, of which nearly three-fourths have been already subscribed. The College was founded in 1786, for "free-teaching and free learning in theology." After successive settlements at York, Manchester, and University Hall, Gordon-square, London, it has recently been removed to Oxford, where it is temporarily housed in the former quarters of Mansfield College, opened in October last.

Peterborough. — The Salvation Army has recently purchased a very prominent site in Cowgate, Peterborough, and intend erecting on the same a large "Citadel" capable of accommodating 1,000 persons, and two large shops. Mr. James Wenlock, builder, of Peterborough, has secured the first contract, but the main portion has not yet been tendered for. The architect is Mr. J. Williams Dunford, of Queen Victoria-street, London. The scheme will cost about 5,000*l.*

Purley (Surrey).—The "John Bentley Gymnasium," in connection with the Warehousemen, Clerks', and Drapers' School at Purley, has been opened by Mr. S. Hope Morley. The gymnasium is the gift to the Institution of Mr. John Bentley, and has been built from plans prepared by Mr. J. Kingwell Cole, architect, London.

Ramsgate.—At a recent meeting of the Ramsgate Town Council, held at the Town-hall, the Mayor in the chair, the following recommendation of the Sands and Cliffs Approaches Committee was unanimously adopted:—"That Mr. W. A. Valon, C.E., Engineer to the Gas and Water Department, be appointed the Engineer to the Corporation for the purpose of preparing the plans and specifications to be annexed to the proposed agreement with the Board of Trade relating to the improvement of the sea-front. The Committee recommended that the plans and specifications relating to the proposed front improvements, as now submitted by Mr. W. A. Valon, be forwarded to the Board of Trade for their approval." The improvements may be summarised as follows:—The north side of the inner harbour is to have a new sea-wall extending from the corner of Harbour-street to the West end, which gives an opportunity of building the front walls of the ornamental arches on the present wall of basin, and forms a good wide road in front of them. On their completion it is intended to clear away the Harbour-stores, Customs-house, and Harbour Master's-house at present in the Pier-yard, and throw it open to the sea, thus widening and improving the approach to the London, Chatham, and Dover Railway Station, making the road in some places 75 ft. wide. On the completion of this work the Albion Hotel will be removed, and a road formed rising at a regular gradient from Harbour-street, so that when the whole is finished there will be an easy and improved approach to both cliffs. By the deepening of the basin, coal vessels and merchant ships will unload alongside the New Military road and Cross Wall opposite, leaving that part immediately facing the hotels and streets clear for gentlemen's yachts. The total cost of the improvements, including compensation, but without recoupments, which will be considerable, amounts to about 65,000*l.*

St. Helen's.—The foundations for the new public baths here having been completed, the contractor, Mr. John Whittaker, of St. Helen's, has commenced to erect the building. Messrs. Thomas Bradford & Co., of London and Manchester, have the contract for plumbing, &c. The building contains a large swimming-bath, 100 ft. by 30 ft.; one for ladies, 48 ft. by 24 ft.; and thirty-nine private baths. The whole building is to cost 10,000*l.*, and is being erected from the design and specification of Mr. Geo. J. C. Broom, the Borough Surveyor. Mr. John Sadler, of Widnes, is the clerk of works.

Walsall.—Mr. W. H. Westwood, of the Gaiety Theatre, Walsall, is about to demolish his present premises and those occupied by Mr. J. Greenslade, outfitter, adjoining, and to erect a new and far more commodious theatre at the corner of Station and Park-streets. The auditorium of the new building will comprise stalls, pit, dress-circle, private boxes, and gallery, and it is promised that from all parts of the house an uninterrupted view of the spacious stage will be obtained. Externally the building is stated to be an entirely new departure from the accepted forms of this class of structure, and is designed in an adaptation of the Romanesque style. The wallings will be principally of red brick, plentifully relieved with stonework, and enriched with carving and sculptured Shakespearian figures, whilst at the angle of the two streets a large carved panel will represent a scene from "The Play in 'Hamlet.'" Towering above the roof at the angle of Station and Park-streets will be a lofty turret, partly covered with lead and copper, richly emblazoned, and with lunettes for electric light, and finished on top with gilded figures representing Painting, Music, and the Drama; these figures support a gilt canopy, surmounted with a high flag-staff. The side next Station-street will be of a plainer character. The ground floor of the building will be occupied principally by commodious bars, smoke-rooms, and their accessories. The total cost of the building and fittings, complete, it is estimated will be about 14,000*l.* The architect is Mr. Daniel Arkell, Birmingham.

CHURCH BUILDING NEWS.

Bournemouth.—Designs by Messrs. Cox, Sons, Buckley, & Co., have been approved for decorating the chancel of St. Michael's Church, Bournemouth, and the works are in progress under the superintendence of Mr. R. G. Pinder, F.R.I.B.A. The upper part of the east wall is to have a representation of the Lamb upon the Book with Seven Seals, and the four Evangelists. The reredos is to be finished in gilt and colour. On the north and south sides of the chancel a procession of apostles, prophets, martyrs, and fathers of the Church is to be represented, to embody the idea of the Te Deum. There will be emblems of the Passion near the altar-rail. Praise is to be represented by groups of angels above the organ-chamber, and other groups will occupy corresponding positions on the opposite side.

Heavitree (near Exeter).—The dedication of the new tower of Heavitree parish church took place on Saturday last. The new tower stands on the site of the old one. The latter was condemned some years before its demolition in 1887 as being unsafe; but it was found, after about 10 ft. had been removed, that the masonry was solid, especially on the south side. Mr. Phillips, of Exeter, the contractor, had to resort to dynamite in order to separate the masonry of the old pile, which was about 45 ft. high, and succeeded in doing so without serious injury being done to the church. In an open competition for designs for rebuilding the tower, the plans of Mr. E. H. Harbottle, architect, Exeter, were selected by Mr. Ewan Christian, of London, the adjudicator. From those plans the new tower has been built, in the Perpendicular style. The foundations are of concrete, and the tower is built of limestone from the Babbacombe Quarries, the main quoins being of Chudleigh limestone with Bath stone dressings. Great care had to be exercised in selecting the stone, some of the blocks being of exceptional dimensions. The height of the tower from the ground to the battlements is something like 101 ft.; the total height to the top of the vane is about 133 ft. Besides being an inauguration of a scheme for extending the church, the new tower is also a memorial of her Majesty's Jubilee. The foundation-stone was laid on August 28, 1888, by Lord Poltimore. The large west window of the tower is to be utilised for the erection of a memorial to the late Rev. R. Barnes, for many years the Vicar of the parish. The memorial is to take the form of a stained-glass window, the artists being Messrs. Clayton & Bell. It is also intended to have a peal of eight bells put in the tower. There has not been a single accident during the progress of the work. Mr. F. S. Mitchell, of Heavitree, has acted as clerk of works; and Mr. E. T. Rogers, of Exeter, has executed the carving. The cost of the work is about 3,000*l.*

London Water Supply.—The Vestry of St. James, Westminster, have invited the other Vestries and district boards of the metropolis to appoint delegates to a conference shortly to be held for the purpose of considering the whole subject of the metropolitan water supply, and especially the desirableness of asking the Government to introduce a Bill (1) either to confer on the County Council power to acquire the present undertakings or to establish a competing supply; and (2) to require the water companies to supply water by meter at a fixed tariff.

The Student's Column.

ELECTRICITY, MAGNETISM, AND ELECTRICITY SUPPLY.—XXII.

DISTRIBUTION—DIRECT SUPPLY.

If a current C pass through mains of resistance R, and e is the electromotive force used in driving the current through them, then $e = C R$, and eC is the power absorbed for this purpose. If E is the electromotive force producing the current, EC is the total amount of power generated and $EC : eC = E : e$. The value of E may now be increased while that of C remains unchanged; this will increase the total power in the same proportion without in any way adding to that lost in the mains. The higher the electromotive force employed the better must be the insulation of the circuit, but it is much less costly to reduce the proportion of the loss in the mains by increasing E and improving the insulation than by using larger mains for the purpose of reducing R. In the various systems now adopted for the distribution of a large amount of power over extended areas, the one object kept in view is to avoid the necessity of carrying large currents for any distance.

The descriptions of the various systems of distribution will be made shorter and clearer by supposing that small electric lamps only, requiring a constant E.M.F. of 100 volts, and a current of 0·5 ampere, are in circuit. When plant is used for which the E.M.F. or current must vary, special regulating devices have to be added to enable such modifications to be made without interfering with the rest of the circuit.

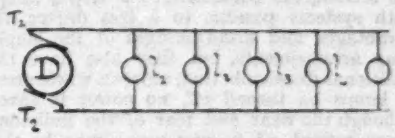


Fig. 58.

When none of the lamps are at a great distance from the generating plant, as in the case of a building which has its own engine-room, a dynamo-machine D, fig. 58, compound-wound to give a constant E.M.F. of 100 volts, is connected to the mains, and all the lamps, l, placed abreast between them.

Any lamp l_1 can be turned off by opening its circuit, without affecting any of the others, since the machine maintains a constant difference of potential of 100 volts between the points T_1 and T_2. The current given by the machine is always proportional to the number of lamps in use, being 0·5 multiplied into this number, and since the E.M.F. is constant, the exact amount of power required for lighting is sent into the mains without waste. For a large number of lamps this arrangement, known as the Simple Parallel System, is impracticable: for, say, 10,000 lamps, 5,000 amperes must be passed through the mains from the machine, and though the distances may be small, the cost of the cables is prohibitory. As each lamp or group of lamps is passed, going along the mains, from the machine, the current becomes less, and the size of the conductor may therefore be reduced, but sufficient saving cannot be made to render the distribution of a large amount of power by this system a commercial possibility.

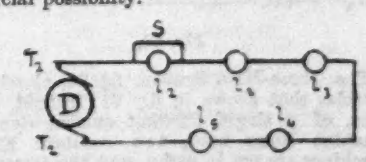


Fig. 59.

In a Simple Series System of distribution all the lamps are placed in series, as in fig. 59, with a constant current dynamo-machine. No matter what the number of lamps, the current never exceeds 0·5 ampere, and a lamp l_1 can be extinguished by a short circuiting switch S. On such a circuit it is the E.M.F. between T_1 and T_2, which is proportional to the number of lamps in use, and, as in the previous case, the power supplied depends upon the lamps actually giving light. It will be seen, however, that should a lamp break, the current through all the rest would be stopped; a piece of apparatus called a "cut-out," for the purpose of automatically filling the breach, must therefore be

attached to each lamp, and so run up the cost of the installation. Nor does a cut-out entirely get over the difficulty, for should it fail to act, or be tampered with, every lamp on the circuit would be extinguished; but, apart from these objections, the E.M.F. required soon renders this system impracticable, though with lamps of special construction taking a much larger current and a reduced E.M.F., it may sometimes be used with advantage for small straggly installations.

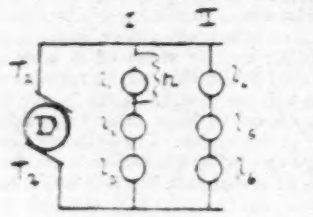


Fig. 60.

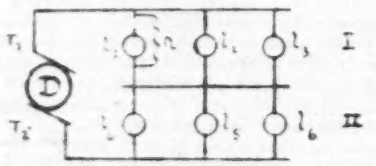


Fig. 61.

Figs. 60 and 61 need not be discussed at length, as they are modifications of figs. 58 and 59 respectively, in which groups of lamps, placed in series in the first case and abreast in the second, are substituted for single lamps. Both systems possess, to a less degree, the advantages and disadvantages of the single-lamp arrangements, but they also have this additional drawback, that, unless a whole group of lamps be turned off, no power is saved, although the wear and tear of the individual lamps turned off in any group may be thus lessened.

In fig. 60, if l_1 is simply open-circuited all the lamps in its group go out; if l_1 is short-circuited the remaining lamps in Group I. are submitted to the full E.M.F. of the mains, and the current through them will be excessive. To turn off l_1, therefore, the current must be diverted through a path of equal resistance, r; the rest of the lamps in the group will not then suffer, but as much power will be used in driving the current through the new path as was previously absorbed by the lamp.

In fig. 61, if l_1 is short-circuited, all the lamps in Group I. are short-circuited also; if, on the other hand, l_1 is open-circuited, the remaining lamps in the group have to divide the whole current from the machine among them, and their life is shortened. In this case also, therefore, an equivalent resistance r must be substituted, and power wasted.

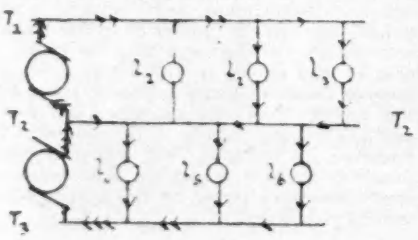


Fig. 62.

The Three-Main System, fig. 62, closely resembles that shown in fig. 61; instead, however, of a single constant current dynamo-machine being used, two constant E.M.F. machines are put in series, and the intermediate main joined to their intermediate terminals. It would, perhaps, be more accurate to describe the three-main system as two complete parallel systems, machines and all, put in series, by which means one intermediate main is made to serve instead of the two in the pair of simple Parallel Systems I. and II. It will also be seen that if a third machine and group of lamps are added, only one additional main is required. If there are the same number of lamps in each group, no current at all flows along the main T_2 T'_2, but if a lamp l_1 is open-circuited, then a current of 0·5 ampere starts from T_2 along the main, as the current from Group I. falls short by 0·5 ampere of that required by Group II. The currents actually flowing in the case drawn are indicated in direction and magnitude by arrow-heads, one arrow-head representing 0·5 ampere. If all the lamps in Group I. are turned off, then machine I. gives no current, and the main T_2 T'_2 has to carry the whole of the current for Group II.

As it is not likely that all the lamps in one group would be turned off while all in the other group would be on, the outer mains only need be of sufficient size to carry the maximum current. It is claimed, in America, that 60 per cent. saving over the simple parallel system has been effected by this means, but 40 per cent. is about what would be saved in this country.

Whatever system of distribution may be adopted the short leads to the lamps, no matter how they may be arranged, will be the same; in estimating the saving effected by any of the above systems over the simple parallel system the mains alone need be considered, and the relative costs can be easily calculated in the following way:—Measure up the length of main L in each case and find the maximum current C it will have to carry. If P is the amount of power allowed to be lost in distribution, a quantity which, for the sake of comparison, will be the same in each case, then $R = \frac{P}{C^2}$ is the resistance the mains may have. If ρ is the specific resistance of the conductor and s the cross-section, then, $s = \frac{\rho L}{R} = \frac{\rho L C^2}{P}$ and the bulk of conductor used is $s L = \frac{\rho L^2 C^2}{P}$ but ρ and P are the same in all cases, hence the cost is proportional to $L^2 C^2$ or $(L C)^2$. The precise way in which L will vary can only be determined by actual measurement for each arrangement of lamps.

When distribution has to be made over wide areas, so-called "feeder-mains" or "feeders" are used. In any of the systems described above, except in the case of the simple series, a certain variation of E.M.F. is experienced by the more distant lamps as the currents in the mains rise and fall. If this variation is excessive, a feeder,—that is, a main from which no branches are led throughout its whole length—is taken from the supply station to a distant point in the circuit, and the *distant* point is kept at a constant potential. The far end of a feeder, therefore, acts like a little local supply station. A feeder-main is, in fact, rather a valuable adjunct to other systems than a system in itself.

VARIORUM.

WE have received the first quarterly part of the current year's volume of the "Journal of the Proceedings of the Royal Society of Antiquaries of Ireland, formerly the Royal Historical and Archæological Association of Ireland" (Dublin: Hodges, Figgis, & Co. London: Williams & Norgate). It is a very interesting number, and contains, amongst other illustrated papers, three which are of special interest, viz., (1) on "Celtic Remains in England," by Mr. John L. Robinson, A.R.H.A.; (2) on "The Ancient Chapter House of the Priory of the Holy Trinity, Dublin," by Mr. Thomas H. Drew, R.H.A.; and (3) on "Ancient Mural Inscriptions," by Mr. J. G. Barry.——"Picturesque Wales," by Godfrey Turner (London: W. J. Adams & Sons, and Simpkin, Marshall, & Co.), is a sixpenny "handbook of scenery accessible from the Cambrian Railways," and although it is published mainly in the interests of the railway companies, and is therefore little more than a tourist's itinerary, it is clearly and pleasantly written, and, as far as we have examined it in detail (we have sampled a great many of its statements, and tested them by comparison with information derived from other and more pretentious handbooks, as well as from personal acquaintance with some of the places), it appears to be tolerably free from errors. In saying this, we must not be supposed to endorse all the archæological theories which the author has adopted (with due acknowledgment in most cases) from other writers. Nor do we necessarily endorse the author's criticisms as to some modern buildings: it would have been more to the purpose if instead of amateur criticism of the style of important modern buildings of a public character he had recorded the names of their architects. Although Strata Florida is mentioned, there is no reference to the important excavations made on the site of the Abbey there within the last two or three years (see *Builder* for October 13, 1888, and May 4, 1889). The book contains two or three maps of the Principality and a great many wood-cuts of the picturesque scenery traversed by the Cambrian Railways. It is very nicely printed on good paper, and will be found exceedingly useful by visitors to those parts of Wales which are served by the Cambrian Railways.——"London in 1890" (London: W. H. Allen & Co.) is this year's edition of the well-known guide-book originally compiled by Mr. Herbert Fry. It is illustrated by two maps and by twenty bird's-eye views of principal streets, and claims to be revised and corrected to date. These claims seem to be fairly well sustained, but we would point out that the correct official title of the body spoken of as the "Metropolitan School Board" is "The School Board for London." The book is also behind the time in saying that the "debates" of the London County Council are held in the Guildhall Council Chamber: they ceased to be held there nearly two months ago. In other respects the book is lacking in information,—for instance, there is no mention of Ravenscourt, Clissold, Waterlow, and Brockwell parks, four considerable additions to the public parks of London,—the first three of which have been actually acquired, while powers to acquire the fourth are being sought in Parliament by the London County Council. But the book contains a fund of information about London, and is copiously indexed. This is its ninth year of publication.

Trade Catalogues.

Messrs. J. Tylor & Sons, of Newgate-street, send us the fifteenth edition of their Illustrated Catalogue (1890), now being issued. It differs from many other catalogues of the kind in being contained within a small compass, though it consists of 500 pages. It is well printed and illustrated, and provided with a convenient index. Its contents, we need hardly say, include descriptions of a great variety of articles required by architects, contractors, and house-owners. The "Compound" wash-out closet described on p. 16 has some good points, the force of the flush being exerted on the water remaining in the trap without change of direction; it is trapped above floor-level, easily cleaned, and available both as a urinal and slop-sink. The catalogue also includes some good lavatory and bath apparatus. The water-meters manufactured by the firm are fully described; they consist of the "Rotary," the "Positive," and the "Bascule;" they have been extensively used for many years. The "Positive" meter registers with great accuracy, and the "Bascule" meter is designed to give a meter-supply at small cost to cottages, &c. It appears to be particularly well adapted to the supply of small communities in the East or other countries abroad. A great variety of pumping apparatus, suitable for both large and small supplies of water, is described, and to those engaged in the work of laying water-mains, a simple appliance, called the "Patent Elastic Clip," will be of interest: it is calculated to effect a great saving in men's time, and makes a perfect joint in less than half the time required when clay is used. Turner's apparatus for tapping mains under pressure (p. 453) is also well worth attention.——Messrs. John Gibbs & Son, of Liverpool, send us their new illustrated descriptive catalogue of warming and ventilating appliances (third edition). It will repay perusal. One of the illustrations is a section of the new wing of the Children's Infirmary, Myrtle-street, Liverpool, showing Messrs. Gibbs's combined system of warming and ventilating.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

8,961, Window Fastenings. E. Hauff.

This invention consists in fixing upon the upper ledge of the lower sash at the side a frame with two cheeks, with a pawl and spring so fixed that it engages with a plate fixed on one of the upright side frames of the top sash. There are recesses in the plate, and to lock the device a pin is inserted in a hole on one side cheek to another cheek on opposite side. The effect of this is that when the sashes are so fixed they can only be moved up or down together, and it is claimed to be a secure fastening.

9,305, Water-closet Basins and Traps. I. Johns.

According to this invention, a combined bowl up or enclosed water-closet basin and trap is made in two parts, capable of being detached. The top piece is formed with projecting flanges or lugs to fit with recesses or sockets on the piece on the under side. The two are then joined by screws, bolts, or cement.

9,760, Ceilings. A. Katz.

According to this invention, wires are stretched across upon the beams or rafters. Upon the wires are supported blocks or plates of papier maché, cement, plaster, &c. When the blocks are in place the joints are filled in, and the under surface of the ceiling is coated with a comparatively thin coat of plaster.

10,044, Warming and Ventilating. Reeve & Ratcliff.

A filtering medium or baffle plate, a swing plate, and regulating valve are used by the inventor to check the heat, and when necessary these plates, &c., are controlled by counter-weighted levers.

10,120, Rising or Falling Hinges. S. H. Wormald.

The hinge which is the subject of this patent is composed in two parts, the parts which form the joint in each half being made so that when they are brought together they form two helical screws, and lock, so that it is impossible to separate one from the other, dispensing with a centre pin. The half fixed to the door-frame remains stationary, the other half rising upon it.

10,348, Tipping Carts or Wagons. T. Hill.

In carts or vans which are mounted on side trunnions, an improvement is effected by this inventor, who provides an elastic pedestal for the trunnions, and an elastic buffer to support the forward part of the van.

NEW APPLICATIONS FOR PATENTS.

May 12.—7,333, W. Phillips, Combined Sash and Casement Window.—7,342, W. Cox, Ventilation of Buildings, &c.—7,360, G. Evans, Fixing Sash Cords, &c.—7,365, C. Bonne, Clamp or Vice.—7,387, A. Boult, Chimney Pot or Cowl.

May 13.—7,401, M. Webb, Floral Decoration for Silvered Plate-Glass.—7,406, W. West, Moulding and Pressing Bricks, Tiles, &c.—7,410, C. & E. Woodliff, Window Fastening.—7,416, T. Kennedy and W. Wright, Door-Handle.—7,427, R. Knickerbocker, Brickmaking Machines.—7,434, A. Bowerman, Sewer Traps.—7,457, R. Stewart, Portable or other Buildings.

May 14.—7,494, W. Harris, Substitute for Tiled Hearths for Fireplaces.

May 15.—7,577, D. White, Filler for French Polishing.

May 16.—7,610, T. Woodward, Eccentric Weather Bar.—7,657, W. Gale, Ferrule or Collar for Painters' Brushes.

May 17.—7,707, D. Bostel, Flushing Water-Closets, &c.—7,718, E. Wethered, Fastening Windows.—7,745, L. Lambert, Nails.

PROVISIONAL SPECIFICATIONS ACCEPTED.

4,718, A. Govan, Hanging Window Sashes.—4,747, A. Richards, Draught Excluders for Doors.—4,756, A. Lallemant, Doors, &c.—5,029, J. Trelionig & J. Westaway, Fire-proof Curtains for Theatres, &c.—5,112, T. Collen & R. Wilson, Opening and Closing Window Sashes.—5,175, G. Shanks & others, Stock and Fitting for Brick Moulds.—5,515, P. Justice, Material for Building purposes.—5,554, G. Salter & H. Trubshaw, Locks and Latches.—5,627, J. Rome, Metallic Trough Flooring for Bridges.—5,745, T. Ure, Waterclosets.—5,746, C. Watts, Ventilating Gear for Opening Continuous Lengths of Lights, &c.—5,753, H. Leggott, Operating Skylights, &c.—5,757, Rhee, Fencing and Railing.—5,995, J. Goodman, Wash-out Closets.—6,089, J. Eckersley & others, Discharge Valves for Water-closet Cisterns.—6,151, W. Clark, Stores and Fire-places.—6,288, W. Tanner, Fire-places.—6,548, W. & H. Stephens, Forcing Drains Water-closets.—7,099, B. McTean, Kilns for Bricks, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

8,071, F. Moore, Self-acting Exhaust Ventilators.—8,225, S. Smith, Cottage Ranges.—8,428, M. May, Artificial Polished or Ground Stone.—8,772, H. Le Mesurier, Exit Doors for Theatres.—8,904, A. Hogan, Machine for Cutting Laths.—10,069, W. Bird, Fanlight Adjustment.—3,025, G. West, Plastering Material.—4,408, F. Adels, Ceiling and Wall Coverings.—4,907, Colthurst, Symons & Co. & W. Pierce, Roofing Tiles.—5,270, G. Jennings, Man-hole Covers, &c.

RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

MAY 10.—By NASH & SON and J. G. ROBINSON & SON (at Saffron Walden).

Saffron Walden, High-st.—F. house and malting, r. £65 ..... £875
F. house and shop, r. £18 p.a. 290
F. premises in Church-st., r. £10 130
F. cottage in Church-st., r. £5 55
Two f. houses in High-st., r. £26 335
Debden-rd.—Four c. cottages, r. £14. 14s. 145
Thaxted-rd.—F. and c. land, 10a. 1r. 12p., r. £20 475
Audley End—F. cottage and enclosure of land, r. £6 150

MAY 15.—By BAXTER, PAYNE, & LEPPER (at Bromley).

Bromley—The f. residence "Westnor," r. £34 .. 1,500
Tweedy-rd.—A plot of f. land 410

MAY 16.—By Mr. G. H. BREADMORE.

Kew—Enerdale-rd.—"Ormesby House," u.t. 36 yrs, g.r. £10 ..... £795
"Woodcote," u.t. 86 yrs., g.r. £10 690
Wandsworth—1 and 2, Nottingham-villas, f. 680

MAY 17.—By DANIEL SMITH, SON, & OAKLEY (at Canterbury).

Sittingbourne (near)—"Fowley Island," 30a. 2r. 28p., f. 250
Whitstable (near)—A plot of f. land, 1a. 3r. 29p. 50

MAY 19.—By MULLETT, BOOKER, & CO.

Hyde-pk.—31, Albion-st., u.t. 32 yrs., g.r. £3, r. £100 1,300
12, Westbourne-ter., u.t. 47 yrs., g.r. £40..... 2,000
5, Somers-mews, u.t. 42 yrs., g.r. £5..... 410

By G. F. FRANCIS.

Chelsea—10, Christchurch-st., u.t. 62 yrs., g.r. £10 515

By H. C. NEWSON.

Tavistock-sq.—Nos. 41 and 42, u.t. 38 yrs., g. r. £20, r. £245 2,880

By ROGERS, CHAPMAN, & THOMAS.

Hyde-pk, Leinster-gardens—L.g.r. of £152. 10s., g.r. £27. 10s., u.t. 60 yrs. 2,710
Marylebone—22, Hadley-st., u.t. 70 yrs., g.r. £4. 10s., r. £30 250

By CHARLES & TUBB.

Paddington—7 and 8, Hereford-st., u.t. 29 yrs., g.r. £32 360
33, Elnathan-mews, u.t. 70 yrs., g.r. £5 220
Plaistow, Brooks-rd.—L.g.r. of £77, u.t. 45 yrs., g.r. £35 390
Brixton—9, Mayall-rd., u.t. 78 yrs., g.r. £5. 5s., r. £40 290

By HASLAM & SON.

Harwell, Berks—The "Bishops Manor Farm" of 196a. 2r. 22p., f. 5,500
The Manor of Bishops Harwell, with its rights, &c. 1,350
An enclosure of f. land, 14 acres 400

By WEATHERALL & GREEN.

Kingsland—14, 18 to 32 (even), Laburnham-st., f., r. £354 p.a. 4,270
F.g.r. of £5, with reversion in 31 yrs. 190
Stoke Newington—39, Howard-st., f., r. £42 p.a.. 645
London-fields—15, The Broadway, u.t. 52 yrs., g.r. £6. 10s., r. £85 1,200
Kingsland—2 and 4, Laburnham-st., u.t. 14 yrs., g.r. £3, r. £67. 12s. 295
6 to 12 (even), Laburnham-st., u.t. 29 yrs., g.r. £30. 14s. 670

MAY 20.—By THURGOOD & MARTIN.

Hornsey—14, Westfield-rd., u.t. 77 yrs., g.r. £6. 6s., r. £33. 16s 150
Stoke Newington, Park-lane—"Albion Lodge," u.t. 32 yrs., g.r. £8 560
South Croydon, Ledbury-rd.—A plot of f. land .. 90

By TABERNACLE & SON.

Lavender-hill—14 to 20 even, Beaufoy-rd., u.t. 79 yrs., g.r. £20 1,180
21, 22, 23, and 25, Beaufoy-rd., u.t. 79 yrs., g.r. £20 1,160

By CHESTERTON & SONS.

Kensington—47, Campden-st., u.t. 33 yrs., g.r. £4. 8s. 280
7, Pembroke-mews, u.t. 28 yrs., g.r. £4. 4s. 390

By WALFORD & WILSHIN.

Anerley—198, Croydon-rd., u.t. 74 yrs., g r. £12. 10s. 315

By DUNN & SOMAN.

Crawley, near—"Akehurst Farm," 21a. 2r. 31p., f., r. £40 900
Haggerston, Dove-row—f., g.r. £50, with reversion in 11 yrs. to £300 a year 2,000
3, 5, and 7, Dove-row, f., r. £54. 12s. 450
Nicholl-st., "Vine Cottage," f., r. £33. 16s. 265
Bethnal-green—46 and 48, Cudworth-st., f., r. £59. 16s. 670
1 to 4, Carlton-pl., f., r. £104 p.a. 1,030
Essex—f. rent-charge of £84. 12s. 5d. p.a. 1,760

By RUSHWORTH & STEVENS.

Oxford-st.—No. 325, and 84, New Bond-st., City leasehold 7,150
Sunbury-on-Thames—"Hawke Villa," and 1a. 3r. 23p., f. and c. 1,250
Maida Vale—18, Warwick-rd., u.t. 48 yrs., g.r. £12 650
Soho—15, Church-st., f., r. £60 p.a. 1,170

By NEWBON & HARDING.

Hoxton—66, Gopsall-st., u.t. 46 yrs., g.r. £6. 10s.. 335
79 and 83, Felton-st., u.t. 29 yrs., g.r. £4, and a g.r. of £3 p.a. 110

By F. J. BISLEY.

Bermondsey—106 and 108, Southwark Pk.-rd., u.t. 47 yrs., g.r. £11. 17s., r. £70 780
42, Dockley-rd., u.t. 46 yrs., g.r. £5, r. £32 ... 320
154, Fort-rd., u.t. 52 yrs., g.r. £5, r. £32. 10s. .. 330
Rotherhithe—41, Clarence-st., f., r. £15. 12s. 185
79, Adam-st., f., r. £16. 18s. 195

By W. C. HERON.

Tufnell Pk.—90, 102, 104, and 106, Mercer's-rd., u.t. 74 yrs., g.r. £29. 10s., r. £170 2,010
102, Mercer's-rd.—u.t. 67 yrs. g.r. £12. 12s. 660

MAY 21.—By PROTHEROE & MORRIS.

Battersea—1 to 23, Cottage-pl., f., r. £349. 14s. p.a. 3,125
Stratford—7, Langthorne-st., f., r. £15. 12s..... 150
Leytonstone—2, Holland-ter., f., r. £22. 2s..... 200

By A. WATSON.

Barnsbury—83, Hemingford-rd., u.t. 52 yrs., g.r. £6..... 430

By BRIANT & SON.

Newington-cres.—Nos. 39 and 40, f., r. £80 p.a... 1,140
35 and 36, Newington-cres., f., r. £74 p.a..... 1,250
Camberwell New-rd.—No. 122, u.t. 11 yrs., no g.r. 200
Brunswick-sq.—7, Compton-st., u.t. 28 yrs., g.r. £15. 15s., r. £45 250
Compton-st.—L.g.r. of £31. 10s., u.t. 23 yrs., g.r. £13 250
Kennington—18, The Ter., u.t. 31 yrs., g.r. £6. 15s. 370

By W. J. NEWELL.

Rotherhithe—43, Derrick-st., f., r. £14 155
33 to 39 (odd), Derrick-st., f., r. £66. 10s. p.a. .. 330
23, 25, 29, and 31, Derrick-st., f., r., £78. 2s. p.a. 460
Lewisham—11, Embleton-st, u.t. 80 yrs., g r. £6, r. £25 205

By DANIELL SMITH, SON, & OAKLEY.

West Norfolk—The freehold residential estate known as "Middleton Towers," 727a. 2r. 36p. £22,000
Potter's-bar—F. building land, 22a. 1r. 21p. 1,750

By R. J. COLLIER.

Finsbury-pk., Lordship-rd.—"Howdale" and "The Cottage," u.t. 77 yrs., g.r. £20, also a l.g.r. of £21, u.t. 77 yrs. 1,570
Hoxton—109, Hyde-rd, u.t. 29 yrs., g.r. 6d., r. £30 p.a. 255
Kingsland—160, Hertford-rd., u.t. 12 yrs., no g.r., r. £28 p.a. 120

By VENTOM, BULL, & COOPER.

Broadstairs, St. Peter's-rd.—"St. Ann's Cottage," f., r. £30 480

By HOBSON, RICHARDS, & CO.

Anerley—4 and 5, Weighton-ter., f., r. £90 1,205
"The Mitre Tavern," f., r. £100 p.a. 1,580

By J. P. HOPE.

Acton—Nos. 2, 3, 4, and 5, The Parade, u.t. 87 yrs., g.r. £40 1,325

By BAKER & SONS.

Hampstead—1, 3, and 4, Fitzjohn's-promenade, u.t. 98 yrs., g.r. £105..... 6,230
5, 7 to 11, Fitzjohn's-promenade, u.t. 98 yrs., g.r. £210..... 11,790
12, 13, 14, and 15, Fitzjohn's-promenade, u.t. 98 yrs., g.r. £140 7,900
20 and 21, Fitzjohn's-promenade, f., r. £350 p.a. 7,000

By EASTMAN BROS.

Forest-hill—161, Devonshire-rd., u.t. 78 yrs., g.r. £6..... 400
Inglemere-rd.—A plot of f. land 350

By WYATT & SON (at Chichester).

Chichester, near—Enclosures of f. land, 18a. 0r. 25p., r. £45..... 680
"Heath's Farm," and 42a. 0r. 11p., r. £70 p.a.. 850

MAY 22.—By E. & H. LUMLEY.

Oxfordshire—"Shotover Lodge," and 31a. 0r. 2p., f. 4,000
F. farm, 20a. 1r. 22p., at Wheatley 1,000
Lewes, Sussex—"The Shelleys," with grounds, f. 3,850

By GLASIER & SONS.

Mayfair—2, Deanery-st., f. 5,250
Westminster—8, 9, and 10, Broadway, f., r. £128 p.a. 3,500

By NORTON, TRIST & GILBERT.

Camberwell—6a, 6 to 16 (even) Coldharbour-lane, f., r. £118 p.a. 1,570
South Croydon—1 to 24, Helder-rd., u.t. 79 yrs., g.r. £25. 15s., r. £347. 2s. 1,950
Regent's Pk—11, Pk. Village East, u.t. 32 yrs., g.r. £12, r. £60 p.a. 300

By DYER, SON & HILTON.

Lee—The Residence "Hillside," u.t. 48 yrs., g.r. £10 1,050
Belgravia—2, Gerald-rd., u.t. 16 yrs., g.r. £30, r. £85 150

By G. HEAD & CO.

Eaton-sq.—52, Chester-ter., u.t. 31 yrs., g.r. £7, r. £65 670
City-rd.—27, 28, and 29, Britannia-st., f. 780

By HUMPHREYS, SKITT & CO.

Greenwich—2, The Circus, f., r. £60 p.a. 790
60, Royal-hill, f., £32 p.a. 350
Blackheath, The Grove—"La Bagatelle," u.t. 31 yrs., g.r. £5, r. £45..... 340

By H. TILLEY.

Camden Town—2, St. Paul's-rd., u.t. 52 yrs., g.r. £7..... 350
Shepherd's Bush—42, Warbeck-rd., f., r. £30 p.a. 335

By C. C. & T. MOORE.

Clapton—3 and 4, Mount Pleasant-lane, u.t. 40 yrs., g.r. £7 565
Mile End—3, Walden-st., u.t. 16½ yrs., g.r. £2. 5s. 120
Bow—93, 95, and 97, Malmesbury-rd., u.t. 57 yrs., g.r. £12 820
Commercial-rd.—5, 6, 7 and 8, Bromley-st., u.t. 7¾ yrs., g.r. £3. 10s. 585
10 to 18 (even) Bromley-st., u.t. 7¾ yrs., g.r. £10 810
10, York-sq., and 3 and 4, Henry-st., u.t. 2 yrs., g.r. £7..... 90

By E. STIMSON.

Old Kent-rd.—No. 519, f., r. £36 550
Kennington-rd.—No. 64, f., r. £52. 10s. 650
Chelsea, King's-rd.—F.g.r. of £12, with reversion in 26 yrs. 750
Mottingham, High-rd.—"Varna Villa," u.t. 79 yrs., g.r. £7. 1s. 100

By C. & H. WHITE.

Clare Market—Nos. 26, 27, and 28, f., r. £53. 14s. 900
Bermondsey—220 and 222, Lynton-rd., u.t. 46 yrs., g.r. £10 430

By NEWBON & HARDING.

Walworth—36, Fleming-st., u.t. 43 yrs., g.r. £4. 4s., r. £28 235
Dalston—59 and 61, Shrubland-grove, u.t. 50 yrs., g.r. £10, r. £62 p.a. 575
252, Richmond-rd., u.t. 55 yrs., g.r. £4, r. £37. 14s. 250
Camden-rd.—61, Hilldrop-cres., u.t. 60 yrs., g.r. 10s. 600
Barnsbury—53, Thornhill-rd., f. 760
42, Hemingford-rd., u.t. 46 yrs., g.r. £7, r. £45 480
Canonbury—67 and 69, St. Paul's-rd., u.t. 46 yrs., g.r. £12 645
Euston-rd.—67, Drummond-st., u.t. 33 yrs., g.r. £20, r. £50..... 360
King's-cross—1 and 2, Field-st., f., r. £59. 16s..... 520

MAY 23.—By R. REID.

Brunswick-sq., Marchmont-st.—I g.r. of £40, u.t. 15 yrs., g.r. £20 130
I.g.r. of £34, u.t., 15 yrs., no g.r. 260

By R. W. SCOBELL.

Greenford—"Greenford Lodge," and 24a. 0r. 1p., f. 4,600
"Greenford Cottage," and 2a. 3r. 28 p., f..... 2,400

By KING & CHASEMORE.

Steyning, near—"Horton Hall," and 274a. 1r, 7p, f. 8,000

By W. W. JENKINSON.

Euston-rd.—I g.r. of £230 p.a., u.t. 29½ yrs., at g.r. of £120, with reversion for 1½ yr. to r. rentals..... 1,480

By RUTLEY, SON, & VINE.

Spitalfields, Duke-st., &c.—F. area of 1,750 ft., r. £50 p.a.	£700
Oakley-sq.—6, 7, and 13, Crawley-mews, u.t. 57 yrs., g.r. £10, r. £110. 10s.	670

By BAKER & SON.

Byfleet, Surrey — "The Model Farm," and 64a. 2r. 36 p., f.	3,750
Enclosures of f. land 23a. 1r. 27p., f.	2,300

[*Contractions used in these lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

MEETINGS.

SATURDAY, MAY 31.

St. Paul's Ecclesiological Society. — Visit to the Churches of Stone and Northfleet. Train leaves Cannon-street (for Greenhithe) at 2.47 p.m.

Association of Municipal and Sanitary Engineers and Surveyors. — Lancashire and Cheshire District Meeting, to be held at Burnley.

Edinburgh Architectural Association.—Annual Excursion to Dunfermline, Inverkeithing, &c.

MONDAY, JUNE 2.

Royal Institute of British Architects.—(1) To receive the report of the Scrutineers as to the election of Council, Standing Committees and Auditors, and to declare the names of those elected. (2) Paper by the Count D'Hulst on "The Arab House in Cairo." 8 p.m.

Surveyors' Institution.—Annual General Meeting to receive the Report of the Council, and the Announcement of the Result of the Election of Officers for the ensuing year. 3 p.m. Annual Dinner, Holborn Restaurant. 6.30 p.m.

Society of Engineers.—Mr. P. F. Nursey on "Pick's System of Manufacturing Salt in Vacuo." 7.30 p.m.

Clerks of Works' Association (Carpenters' Hall).—Mr. T. Edmond on "Eddystone Lighthouse." 8 p.m.

Royal Institution.—General Monthly Meeting. 5 p.m.

TUESDAY, JUNE 3.

Institution of Civil Engineers. — Annual General Meeting to receive the Report of the Council and to elect the Council and Officers for the ensuing year. 8 p.m.

Society of Biblical Archæology.—8 p.m.

WEDNESDAY, JUNE 4.

British Archæological Association.—Mr. J. T. Irvine on "Barholme Church, Lincolnshire, and its bearing on so-called Saxon Architecture." 8 p.m.

THURSDAY, JUNE 5.

Royal Institution.—Professor Dewar, M.A., F.R.S., on "Flame and Explosives."

Society for the Encouragement of the Fine Arts.—Third Conversazione. 8 p.m.

Royal Archæological Institute.—Four papers to be read, including one by Mr. H. S. Cowper on "Brasses in the Parish Churches of Willesden, Great Greenford, and Acton." 4 p.m.

FRIDAY, JUNE 6.

Royal Institution.—Professor W. Boyd Dawkins, M.A., F.R.S., on "The Search for Coal in the South of England." 9 p.m.

Miscellanea.

"Fortis."—Under the name of "fortis," a new blasting agent is about to be introduced into practical use in this country. Fortis belongs to the class of high explosives, and was invented some three years since. As soon as the invention had assumed a practical shape, a factory was started at Herenthals, Belgium, where it can be turned out at the rate of about seven or eight tons per week. The powder finds in Belgium a ready sale with mine and quarry proprietors. It is composed of nitrate of potash, sulphur, tan, glycerine, and some few other ingredients, and is made of five different strengths and qualities to suit the varied requirements of mining. Fortis No. 1 is less strong than gunpowder, while No. 5 is equal in strength to dynamite. It was tested last year at the Bolehill Limestone Quarries, near Sheffield, by Mr. Perry F. Nursey, C.E., the results being in every way satisfactory. The modified action of the various numbers of the powder was demonstrated, and the strength of the powder of the quality suitable for limestone was shown to be about three times that of ordinary English blasting-powder. Its action on granite was successfully tried by Mr. C. Napier Hake, F.I.C., at the Mount Sorrel Granite Quarries, Loughborough. It was there proved that Fortis developed about two and a-half times the power of ordinary blasting-powder, the work being done in a very satisfactory manner. It would appear to be well adapted for all purposes of coal-mining, quarrying granite, stone, and slate, and it can be used with greater advantage and economy than gunpowder.—*Iron.*

The late City Architect of Glasgow.—The Council of the Glasgow Institute of Architects have agreed to place upon record their deep sense of the loss sustained by the city, the architectural profession, and the Institute, by the death of Mr. John Carrick, the Glasgow City Architect.

Smoke Abatement.—A meeting was held last week at the Mansion House, under the presidency of the Lord Mayor, for the purpose of bringing before the public the subject of smoke abatement.—Mr. Fred Scott, the secretary, read a number of letters of apology and sympathy with the object from noblemen and others, including the Duke of Westminster, the Earl of Rosebery, Lord Egerton of Tatton, Earl Percy, Viscount Cross, Lord Rayleigh, the Mayors of Manchester, Nottingham, Sheffield, and Leicester.—Mr. A. E. Fletcher, Chief Inspector of Alkali Works and Chairman of the Executive Committee for Testing Smoke-preventing Appliances, explained the objects the Committee had in view, which were, he said, to test the various known appliances thoroughly by going where they were in operation, and reporting on the kind of coal used and the conditions under which the appliances were used, and when they had found out all ascertainable facts, they would publish a report that would give all the information that could be required by any person who wished to rid his chimney of black smoke.—Lord Derby moved a resolution approving of the objects of the Committee, and in doing so said the diminution of smoke and the necessary accompaniment of dirt was a matter that concerned everybody. He wished he could say that it interested everybody. He regretted to say that it did not. Indifference was the real evil which they had to encounter. His lordship proceeded to point out the waste of coal itself that at present prevailed, and the injury to property caused by perpetual dirt; and in regard to the important subject of injury to health, he remarked that an oak would not flourish near London or Manchester or Liverpool, and he would leave them to judge if an atmosphere that killed an oak could be beneficial to a child. He believed that three-fourths or even nine-tenths of the smoke was absolutely unnecessary and preventable. They must produce a strong public feeling on the subject.—Lord Howard of Glossop seconded the resolution, which was carried unanimously.—Sir H. E. Roscoe, M.P., proposed, "That it is necessary to raise a fund to meet the expenses of this work, and this meeting pledges itself to use its best efforts to this end."—Earl Fitzwilliam seconded the resolution, which was carried.

Surveyorship, Chelmsford.—At a special meeting of the Chelmsford Town Council last week, the following letter was read from Mr. Charles Pertwee, the Borough Surveyor:—

"Surveyor's Office, May 12.

Dear Mr. Mayor,—I regret to say that, having lost nerve and vital power, I am compelled to seek, under medical advice, recuperation in rest and change of air. I intend leaving home to-morrow. My clerk, Mr. Mawhood, will attend the committee and other meetings in my absence, and render such assistance as, in conjunction with Mr. Batten, he may be able. I should be glad if you would ask the Council to take into their consideration the question of the relieving me of my official duties, as it is my intention, at such date as may suit the convenience of the Corporation, in the near future to place my resignation as Borough Surveyor in the hands of the Council. At the same time I am most anxious, if circumstances permit, to complete the new water scheme, various details of which remain still to be carried out, so that the town may be in possession of the increased water supply so much needed.—I am, dear Mr. Mayor, faithfully yours, CHARLES PERTWEE."

—Councillor Chancellor said that this was one of the most important communications they had received for some time past. The office of Borough Surveyor had become very important, and he thought the time had now arrived when it should be looked at in all its bearings. He proposed that the matter should be referred to the General Purposes Committee, who should thoroughly thresh it out, and put before the Council some definite proposition.—The motion was seconded by Councillor Gepp, and carried unanimously.

Value of New River Shares.—Last week Mr. Bousfield (of the firm of Edwin Fox & Bousfield) submitted to auction at the Mart, Tokenhouse-yard, a King's freehold share in the New River Company. Not for three centuries had a King's undivided share been offered for sale, and the event naturally drew together a very large number of gentlemen. This share came into the market through the death of the late owner. The only guide to the value of the share was furnished by the sale in July last of an entire Adventurers' Share, which realised 122,800*l.* The bidding commenced at 80,000*l.*, and went on slowly to 95,100*l.*, at which price the hammer fell.—*Standard.*

Hucknall Torkard Drainage.—Some time ago (says the *Nottingham Guardian* of the 23rd inst.) the Hucknall Torkard Local Board invited competitive designs from engineers for dealing with the disposal of the sewage at the various outfalls, and for the best means of effectually treating the same. After considerable discussion the scheme submitted by Mr. Herbert Walker, Assoc.-M.Inst.C.E., and Mr. W. H. Radford, Assoc.-M.Inst.C.E., were selected for further consideration, with the result that the scheme submitted by Mr. Walker was eventually selected by the Local Board. The system advocated by Mr. Walker is that known as the "international process," and consists of (1) the precipitation and deodorisation of the sewage by means of a magnetic precipitant and deodorant called "ferozone," which is produced from polarite by a chemical process; (2) the removal of the organic matter in solution, and the aëration of the tank effluent by passing it through a specially-constructed filter-bed containing polarite, a pure and absolutely insoluble mineral substance, very hard, porous, and absorbent. The sewage will be conducted into precipitation tanks of a capacity to suit the hourly flow of sewage. Immediately before entering the tanks the sewage will receive a dose of "ferozone" by means of a patent automatic sewage-mixer. After remaining in the tank a short time it will be drawn therefrom by a floating arm and conducted over the surface of the polarite filters. These filters are formed of 6 in. of broken stones (in which 4-in. agricultural drain-pipes are embedded), 3 in. of gravel, 6 in. of sand, 12 in. of sand and polarite in equal quantities, and 9 in. of fine sand, making a total depth of filtering material of 3 ft. The sludge deposited in the tanks will be inoffensive, having been deodorised by the ferozone. This sludge will be forced into filter-presses, and pressed into cakes ready for sale as a fertiliser. The effluent, after being passed over and through about four acres of land, will be conducted into the river Leen. Storm overflows will be arranged at various points, so that the storm-water will find its way direct into the river, and only the sewage will be conducted to the tanks for purification. The estimated cost of this scheme is about 4,000*l.*

Defective Sanitary Condition of Derbyshire Infirmary.—At a meeting of the Governors of the Derbyshire Infirmary, at Derby, on the 22nd inst., a report was presented from Messrs. Young & Hall, architects, London, who had been specially appointed to examine the building owing to the discovery of sanitary defects, which had led to an epidemic of typhoid fever amongst the nurses. The report disclosed a very serious state of affairs, the drainage being so bad that work was recommended which would cost 50,000*l.*, and as an alternative the architects suggested the entire reconstruction of the Infirmary, at a cost of about 60,000*l.* The President, Sir William Evans, said all the in-patients who could be sent away had been removed, and no fresh ones were being admitted. A house had been hired for the nurses to sleep at, and a temporary wooden hospital had been erected in the grounds for cases of accident or emergency. It was proposed to erect hospital tents in the grounds for the treatment of those who could not be accommodated in the wooden building. A strong committee was appointed to consider the best course to pursue in this serious crisis. It was stated that the institution had been regarded as a model hospital. The older part of it was built about seventy years ago.—*Leeds Mercury.*

Discovery of Wooden Water-Pipes in Belfast.—While workmen were engaged excavating for the foundations of an addition to Messrs. Lindsay's wholesale premises, now extending from Donegall-place to Fountain-street, Belfast, they came upon a curiosity in the shape of a number of wooden water-pipes. The *Belfast Newsletter* says that the main pipe is in the form of a square log of solid wood. In the centre of this a round hole is cut, through which the water flowed. At several points in the main there are holes for the joining of smaller pipes, a number of which have also been discovered. The wood, which of course is in an advanced stage of decay, having, it is believed, been embedded since 1678, is a species of memel. It is assumed that these are some of the pipes which supplied the fountain which at one time played there, and from which the street took its name. Mr. Wm. M'Cammond, J.P., the builder of the new premises, transferred the find to the Museum.

Edinburgh Architectural Association.—On Saturday afternoon last the members of the Edinburgh Architectural Association proceeded by train to Bathgate, and thence went to Bridge Castle, which they inspected under the leadership of Mr. Thomas Bonnar. In pointing out the interesting features of the building, Mr. Bonnar described it as a Baronial mansion of the regality of Ogilface, in the parish of Torphichen, situated in a beautifully-wooded dell rising up from the Barbauchan Burn, a small tributary of the Avon. The castle was originally of the L plan, but a smaller block containing a kitchen has been added to the south of the wing. It has been considerably altered from its original construction, and has been converted from a ruin into a comfortable mansion within the memory of living persons. The whole of the ground-floor is vaulted in the larger block. On the basement there is a kitchen with two cellars, and on the first floor of the south or smaller block there is another vaulted kitchen with a fine arched fireplace, having a recess at one end. After having inspected the building and other objects of interest, a cordial vote of thanks was accorded to Mr. Thomas Hope, of Bridge Castle, for his courtesy in permitting the visit. The party then proceeded to Torphichen, which Mr. Bonnar said was historically interesting from its association with the once powerful and famous order of military churchmen, the Knights of St. John of Jerusalem, who were also known as the Knights of Malta and of Rhodes. The Preceptory at Torphichen was established by King David I., that "Sair Sanct for the Crown," and was by him richly endowed. Of the cruciform church of the Preceptory, the chancel and nave have entirely disappeared, and there is only left a portion of the transept or "quier," which is Early Second pointed in style, and the site of the nave is now occupied by an edifice of a very different character from it—the plain modern parish church. Mr. Bonnar briefly sketched some of the incidents connected with the order and its preceptors from the date of its establishment in 1153 until the final suppression and extinction of the Knights of St. John in 1560, when Sir James Sandilands, the last on the list of Grand Priors, became Protestant at the Reformation, and joined the Reformers, and was rewarded by his adherence to the new order of things by receiving possession of the remaining estates of the order for a payment of 10,000 crowns and a small annual rent. He was also raised to the peerage under the title of Lord Torphichen. On the conclusion of Mr. Bonnar's remarks, a hearty vote of thanks was awarded to him for his interesting papers. The party afterwards proceeded to Linlithgow.

Western Infirmary, Glasgow.—By the munificence of Colonel Hozier, of Mauldslie Castle, a convalescent home, with land attached, situated in the Lanark district, has been given to the infirmary. The building in question was originally fitted, at a cost of 5,000*l.*, for use as a military store-house.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	6	10	0	7	10	0
Teak, E.I. ....load	11	0	0	14	0	0
Sequoia, U.S. ....foot cube	0	2	3	0	3	0
Ash, Canada ....load	3	0	0	4	10	0
Birch "	3	0	0	5	0	0
Elm "	3	10	0	4	15	0
Fir, Dantzic, &c.	1	15	0	3	10	0
Oak "	2	10	0	4	10	0
Canada	5	10	0	6	10	0
Pine, Canada red	2	10	0	3	10	0
" yellow	2	0	0	5	5	0
Lath, Dantzic ....fathom	5	0	0	6	0	0
St. Petersburg	5	0	0	7	0	0
Wainscot, Riga, &c. ....log	0	0	0	0	0	0
Deals, Finland, 2nd and 1st. std. 100	7	10	0	10	0	0
" " 4th and 3rd	7	0	0	7	10	0
Riga	6	0	0	8	10	0
St. Petersburg, 1st yellow	9	10	0	14	0	0
" 2nd "	7	10	0	9	0	0
Swedish " white	6	10	0	10	0	0
White Sea	7	0	0	15	10	0
Canada, Pine, 1st	8	0	0	17	0	0
" " 2nd	15	0	0	26	0	0
" " 3rd, &c.	10	0	0	16	10	0
" Spruce, 1st	7	0	0	10	0	0
" " 3rd and 2nd ..	8	15	0	11	0	0
New Brunswick, &c.	6	10	0	8	10	0
Battens, all kinds	6	0	0	8	0	0
Flooring Boards, sq., 1 in., prepared, First	5	0	0	16	0	0
Second	0	10	0	0	14	0
Other qualities	0	8	0	0	10	6
	0	6	0	0	7	9

TIMBER *(continued)*.	£.	s.	d.	£.	s.	d.
Cedar, Cuba ....foot	0	0	4	0	0	4½
Honduras, &c.	0	0	4	0	0	4½
Mahogany, Cuba	0	0	4½	0	0	6½
St. Domingo, cargo average ..	0	0	5	0	0	6½
Mexican "	0	0	4½	0	0	5½
Tobasco "	0	0	5½	0	0	6½
Honduras "	0	0	5½	0	0	6½
Box, Turkey ....ton	4	0	0	13	0	0
Rose, Rio	14	0	0	20	0	0
Bahia	13	0	0	18	0	0
Satin, St. Domingo....foot	0	0	6	0	1	3
Porto Rico	0	0	9	0	1	3
Walnut, Italian	0	0	4	0	0	7
METALS.						
IRON—Bar, Welsh, in London tn	6	17	6	8	0	0
" " at works in Wales	6	10	0	7	0	0
" Staffordshire, in London..	8	0	0	8	10	0
COPPER—British, cake and ingot	57	10	0	58	10	0
Best selected	60	0	0	61	0	0
Sheets, strong	66	0	0	67	0	0
Chili, bars	54	7	6	0	0	0
YELLOW METAL....lb.	0	0	5½	0	0	0

METALS *(continued)*.	£.	s.	d.	£.	s.	d.
LEAD—Pig, Spanish ....ton	13	0	0	0	0	0
English, com. brands	13	2	6	13	5	0
Sheet, English, 3 lbs. per square foot and upwards....	15	0	0	0	0	0
Pipe	15	10	0	0	0	0
TIN—						
Straits	95	0	0	0	0	0
Australian	95	0	0	0	0	0
English Ingots	98	0	0	0	0	0
OILS.						
Linseed ....ton	23	15	0	24	2	6
Cocoanut, Cochin	29	10	0	0	0	0
Cocoanut, Ceylon	25	10	0	0	0	0
Palm, Lagos	25	10	0	0	0	0
Rapeseed, English pale	32	10	0	0	0	0
" brown	30	15	0	31	0	0
Cottonseed, refined	22	10	0	0	0	0
Tallow and Oleine	21	0	0	40	0	0
Lubricating, U.S.	5	10	0	6	0	0
" refined	7	0	0	12	0	0
TAR—Stockholm ....barrel	1	6	0	0	0	0
Archangel	0	16	9	0	0	0

COMPETITIONS, CONTRACTS & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom Required.	Premium.	Designs to be delivered.	Page
Public Library	Bermondsey Public Libraries Commrs. ...	Not stated	July 5th	ii.
New Buildings	Ashton, Stalybridge, &c. Carriage Co. Limited	£50, £30, & £20	July 14th	ii.

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Purchase and taking down Curtain Wall ...	York County Com.	....	June 2nd	xiii.
Making-good Street	Southend Local Board	Peter Dodd	June 3rd	xiv.
Reparation and Cleansing of Sewers	Com. of Sewers	*Official*	do.	ii.
Painting, &c., Works at Asylum	Managers, Poplar, &c., Sick Asylum District	A. & C. Harston	do.	xiii.
Roadmaking Works	Willesden Local Board	O. Claude Robson	do.	ii.
Painting, Repairs, &c., Caterham Asylum...	Met. Asylums Board ...	*Official*	June 5th	xiii.
Additional Baths, do. ...	do.	do.	do.	xiii.
Works at Bristol, Wisbech, and St. Pancras	M. R. Co.	do.	June 6th	xiv.
Painting, &c., Station Buildings, &c.	do.	do.	do.	xiv.
Road Works	Beckenham Local Bd.	G. B. Carlton	June 9th	xiv.
Asphalte Paving	Finchley Local Board	*Official*	do.	xiv.
Waterworks	Sandbach Local Board	W. Wyatt	do.	ii.
General Paving Works	West Ham Council....	Lewis Angell	June 10th	xiv.
Works and Materials	do.	do.	do.	xiv.
Coal	do.	do.	do.	xiv.
Roadmaking and Paving Works	Lewisham Bd. of Wks.	*Official*	do.	xv.
Roadmaking Works	do.	do.	do.	xv.
Broken Granite and Granite Setts	Croydon Council	W. Powell	do.	xiii.
Broken Granite	Mile End Vestry	J. M. Knight	June 11th	xiii.
Roadmaking and Paving Works	Fulham Vestry	W. Sykes	do.	xiv.
Alterations, &c., to Vestry Hall	St. John (Hampstead) Vestry	*Official*	June 12th	xiii.
Four New Houses and Alterations, Norfolk	Admiralty	do.	June 13th	ii.
County Hall and Offices at Beverley	East Riding County C.	Smith & Brodrick	do.	ii.
Postmen's Offices, Hampstead	Com. of H.M. Works...	*Official*	do.	xv.
Wood Pavements	Com. of Sewers	do.	do.	xiii.
Smiths' Work	do.	do.	June 17th	xiii.
Making-up and Sewering Roads	Chiswick Local Board	— Ramsden	June 18th	xiv.
New Buildings, Roman-road, E.	Com. of P.B. & W. Bow	Harnor & Pinches	June 23rd	xv
Iron Roofs, Valves, Castings, &c.	Huddersfield Corp.	R. S. Dugdale	June 25th	xiii.
Painting, &c., Works, Isle of Wight	War Department	*Official*	Not stated	ii.
Renewing Floors, R.A. Barracks, Woolwich	do.	do.	do.	ii.
Chimney Shaft, Newmarket	....	[Messrs. Manning	do.	xiii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Surveyor	Rawtenstall Local Bd.	£175, &c.	June 3rd	xviii.
Inspector of Nuisances	Leyton Local Board ...	£120	June 9th	xviii.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

ACTON.—For the erection of the Beaumont Park Board Schools, with the boundary walls, and the making-up of play-grounds and drainage work of same, for the School Board for Acton. Mr. Edward Monson, jun., A.R.I.B.A., Architect to the Board :—

H. C. Clifton, Bayswater	£16,416 0 0
G. Lyford, Shepherd's Bush	12,300 0 0
Allen & Son, Kilburn	12,100 0 0
W. Tout, Hendon	12,087 0 0
Balaam Brothers, Old Kent-road..	12,020 0 0
Scharien & Co., Chelsea	11,743 0 0
Brass & Son, Old-street, E.C.	11,673 0 0
F. & H. F. Higgs, Loughborough Junction	11,500 0 0
Lawrence & Son, City-road	11,425 0 0
J. T. Chappell, Pimlico	11,472 0 0
Shillitoe & Son, Bury St. Edmunds	11,400 0 0
Flew & Co., West Kensington....	11,347 0 0
Stimpson & Co., Brompton	11,360 0 0
T. Nye, Ealing	11,326 0 0
G. Hooper, Acton (accepted)....	11,050 0 0
S. & W. Pattinson, Sleaford	10,938 0 0
H. G. Heywood, Hammersmith ..	10,240 0 0

BRANDON COLLIERY (Durham).—For alteration to premises for Mr. T. Lamb. Messrs. Plummer & Burrell, architects, Newcastle :—

J. Kell, Durham	£144 11 10
G. Lazenby, Mainsforth (accepted)..	125 6 3

BRIGHTON.—For alterations to No. 31, Edward-street, to adapt the same for the purposes of the Salvation Army. Mr. J. Williams Dunford and Mr. W. Gilbee Scott, joint architects :—

F. J. Coxhead, Leytonstone*	£955 0 0

* Accepted.

CHESTER-LE-STREET (Durham).—For further alterations to premises for Mr. J. W. Luccock. Messrs. Plummer & Burrell, architects, Newcastle-on-Tyne :—

Thompson & Sons, Chester-le-Street	£232 17 2
John Jennings, jun., Chester-le-Street	204 8 0
Wm. Norman, Chester-le-Street	194 18 0
Henry Mole, Chester-le-Street*	184 16 0

* Accepted.

DOLGELLEY.—For raising the Penmaenpool Embankment. Mr. Thomas Roberts, Assoc.-M. Inst.C.E., engineer, Portmadoc :—

James Roberts, Dolgelley	£280 0 0
Robert Williams, Harlech	273 0 0

[Engineer's estimate, £276.]

LONDON.—For new boiler-house and engine-room at Acre-street, Wandsworth, for the Projectile Company, Limited. No quantities. Messrs. Tolley & Son, architects, 66, Cannon-street, E.C. :—

Shepherd, London	£3,300 0 0
Marriage, Croydon	2,890 0 0
Waddington & Co., Limited, Sydenham (accepted)	2,691 0 0

LONDON.—For building chimney-shaft at Acre-street, Wandsworth, for the Projectile Company, Limited. Revised specification. Messrs. Tolley & Son, architects, 66, Cannon-street, E.C.:—

Waddington & Co., Limited, Sydenham (accepted)	£1,193 0 0

LONDON.—For constructing roads and sewers at Hampstead, for Sir Spencer Maryon Wilson. Messrs. Farebrother, Ellis, Clark & Co., surveyors:—

Neave	£2,190 0 0
Nowell & Robson	2,170 0 0
Ballard	2,164 0 0
Killingback & Co.	2,135 0 0
Watts	2,075 0 0
Rogers (accepted)	1,990 0 0

LONDON.—For the rebuilding of the "King's Arms" public-house, Abbey-street, Bethnal Green, for Mr. J. Johnson. Messrs. Hammack & Lambert, architects, 59, Bishopsgate-street:—

W. J. Lister & Co.	£2,315 0 0
F. & F. J. Wood	2,253 0 0
S. Goodall	2,240 0 0
Gould & Brand	2,219 0 0
Charles Cox	2,150 0 0
J. Hearle & Son	2,145 0 0

LONDON.—For constructing pipe sewers with flushing tanks, manholes, &c., for the Hampstead Vestry:—

Killingback & Co.	£723 0 0
Ballard	715 0 0
Neave	684 0 0
Nowell & Robson	684 0 0
Wall	679 0 0
Rogers (accepted)	667 0 0

LONDON.—For alterations and repairs to No. 1, Kensington-gardens-square, Bayswater, W. Mr. W. Jacomb Gibbon, architect, 36, Great James-street, Bedford-row, W.C.:—

Ware Bros.	£896 0 0
Chapman	887 0 0
Nunn	772 0 0
Macfarlane	750 0 0
Oldrey & Co. (accepted)	694 0 0

LONDON.—For alterations to hall and vestibule of 101, Queen Victoria-street, to form Post-office, &c. Mr. J. Williams Dunford, architect:—

F. J. Coxhead, Leytonstone*	£265 0 0

* Accepted.

PORTMADOC.—For retaining wall, Garth-road, Portmadoc. Mr. Thomas Roberts, Assoc.-M. Inst.C.E., engineer, Portmadoc:—

Griffith Williams, Harlech	£250 0 0
Rowland Humphreys, Morfabychan	236 10 0
Evan Humphreys, Borth (accepted)	152 10 0
Robert Williams, Harlech	149 0 0

[Engineer's estimate, £182. 8s.]

SWANLEY JUNCTION (Kent).—For new Post-office, &c., at Hextable. Mr. William Hunt, architect, 5, York-buildings, Adelphi, W.C.:—

Calnan & Co.	£819 0 0
E. Saunders	736 0 0
Knight	689 0 0
Smith & Bulled	680 0 0
Podger	665 0 0
J. Saunders (late)	643 0 0
Sayers & Son (accepted)	630 0 0

Factory at Harrow.—Messrs. John Allen & Sons, builders, Palmerston Works, Kilburn, write under date May 23 to say that the list of tenders for this work which appeared in our last was incorrect. They say that the work is in their hands, but the amount is not yet settled.

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TO CORRESPONDENTS.

W. R. (the building is an interesting relic, but unless we knew the precise circumstances under which it was proposed to remove it, we should hardly like to express an opinion one way or the other).—W. F. A.—J. K.—W. R.—M. S. (no address).—S. & B.—E. V.—T. R.—"Surveyor" (next week).

All statements of facts, lists of tenders, &c. must be accompanied by the name and address of the sender, not necessarily for publication.

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